

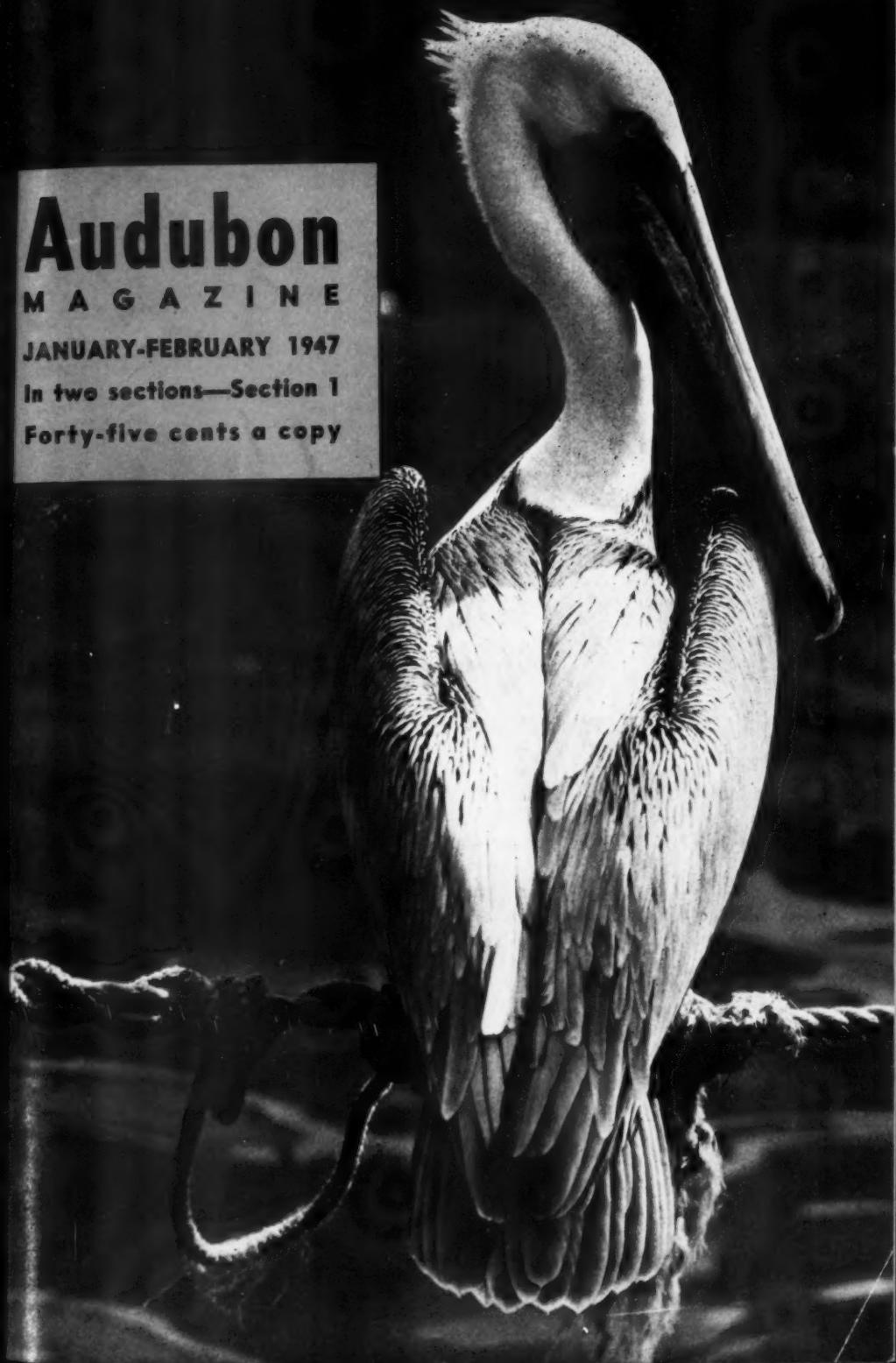
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JANUARY-FEBRUARY 1947

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*On the Delta National Wildlife Refuge, man works
with the changing forces of nature to provide for
the thousands of waterfowl wintering in this area*

DIVIDED WATERS

By John V. Dennis





ON the Mississippi delta geology has reversed itself. The river is higher than the surrounding country instead of lower. It divides into many smaller branches instead of becoming broader and deeper. The appearance and disappearance of outstanding geographical features, which normally take centuries or even geological ages, take only months or years. Today's maps are obsolete tomorrow as water becomes marsh and marsh reverts back to water.

An area of some eighty square miles on the east bank of the Mississippi was nothing but an expanse of the Gulf of Mexico before the Civil War. Then as now, the local inhabitants grazed their cattle on the grass-covered banks of the river. A certain family had difficulty in keeping their cattle from roving too far along the river banks. It was the only place for them to go since just this narrow strip of land separated the Mississippi from the gulf. Two girls in the family decided to solve the problem.

Blue geese (photographed, left, by Allan D. Cruickshank) fly straight to the Gulf Coast from Baffin Island.

Above, right, the refuge patrol boat leaves its wake in Long Island Bayou. Nearer the Gulf, the willows give way to marsh. (Photograph by the author.)

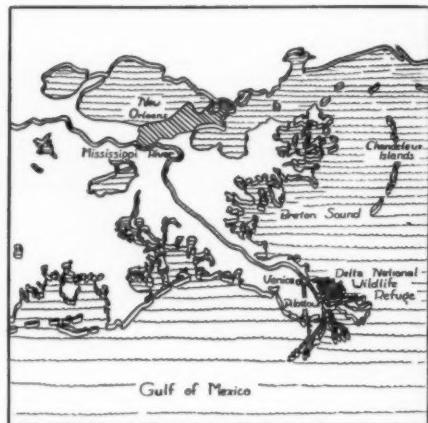
Taking shovels they dug a little every day until they had a sizeable ditch between the gulf and the Mississippi. They may have been somewhat alarmed when they saw the water rush through seeking the lower level of the gulf. But it served its purpose as a cattle barrier.

Perhaps while they were still digging, they looked up and found angry-looking gunboats and frigates full of men and cannon slowly moving up the river. Farragut's fleet had arrived. Before blasting its way toward New Orleans, it anchored here. Anxious to do a little exploring, parties set out in long boats, the men looking with tempting eyes toward the great expanse of the gulf. They found only one possible way to get their boats through and that was by the recently dug ditch. It needed to be widened, however, so the men eagerly set to work. Soon water was pouring through in great torrents and the boats swept along with it to the delight of the men.

Today that little ditch is over a mile wide and what was blue gulf water is a great expanse of marsh, islands, rivers and ponds. It grew at an incredible rate, always following a set pattern. Long fingers of water spread out from the original break in the river bank, depositing silt wherever they flowed. Rivers without banks, they formed banks. Shallow water in between became marsh dot-

ted with ponds. Such progressions were not new to the delta inhabitants and they had names to describe the geological features which developed.

The main water courses were passes. Passes divided into smaller passes. If small enough they were coulees. Other waterways, often large but not having a definite course, were bayous. Where passes emptied their muddy water into the gulf, land formed most rapidly. Long dual strips of land reached out into the gulf; they were like tape, marking the course of each pass. In between those projections were bays, usually called bends. Bends are a transitory phase in



Below, a log jam overgrown with water hyacinth and alligator weed impedes travel and lessens the value of the marsh to water-fowl. If it were not removed by the Fish and Wildlife Service, the pass would eventually fill in. (Photograph by the author.)

Above, the delta region showing the refuge, reached only by boat, some seventy miles below New Orleans. Included are the Chandeleur Islands, an uninhabited barrier group, remains of an ancient delta. (Map by Howard A. Gray.)





During the winter, geese will root up the three square bulrushes in the background

and ducks will eat the delta duckpotatoes at the left. (Photograph by the author.)

the composition of a delta. In a short time silt deposits from the out-pouring passes work around the entrance to such bays and seal them off from the gulf. The captured body of water thence becomes known as a pond. The pond will be located on what is really an island, for from the point where a pass divides into two or more smaller passes, the marsh is enclosed, first by those diverging bodies of water and then by the gulf itself.

Adjacent to this pond but farther inland, there will, in most cases, be another pond-formed, however, in a different manner. The interior portion of the island is subsiding due to sediment no longer accumulating here but farther downstream. Water reoccupies the sinking area and a pond comes into existence. The two ponds which have formed almost simultaneously are called outside and inside ponds. In time they may become joined into one large pond. Even

while they are evolving, the passes may have divided again and new islands with their ponds are taking shape. Thus the marsh grew, from the first inside pond through a maze of dividing passes, each embracing islands containing ponds, all the way to the warm waters of the gulf where today bends are in the process of becoming outside ponds.

Marching in advance of this array, even out into the shallow waters of the gulf, are plants. Some have arrow-shaped leaves and others consist of long needlelike shafts. In their wake comes a profusion of other types which will eventually crowd them out. The earliest arrivals are unexcelled as food for geese and ducks. The ponds grow other duck foods as does, to a lesser extent, the interior marsh. With such conditions it is no wonder that the autumn skies over the delta are filled with great waving lines of geese and ducks.

During most of the time when the

great marsh was spreading ever farther into the gulf, man was indifferent or hostile toward the descending flocks of waterfowl. They were shot for disturbing planted rice or as an addition to the local diet. Eventually it was found that a handsome profit could be made by shipping thousands of slaughtered geese and ducks to New Orleans where there

was a ready market. Sportsmen too became acquainted with the region and bought up huge areas as shooting preserves. There was no limit. It used to be considered sport to hold competitions to see who could shoot the most ducks in one day. Using all the methods which are illegal today, it was occasionally possible for one man to kill over a thousand

On this sizable section of the refuge, Raphael and Octave Passes are two of three main waterways resulting from the breakthrough of the Mississippi in 1862. Typical smaller passes are Flatboat, Joe Brown and Twenty-Seven. Leading nowhere in particu-

lar is Dead Man's Bayou. Bends, foredoomed to become outside ponds, are Dead Women, Bucket and Hingle. Inside and outside ponds, almost always in pairs, are abundant. (Map drawn to a scale of two inches to one mile, by Howard A. Gray.)



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The alligator weed in the foreground is a major obstacle to navigation, even for the little duckboat shown beached here. The roseau cane in the background is almost impenetrable for man. Both plants take up space that might have been growing useful food crops for wildfowl.

(Photograph by the author.)

ducks, starting from early dawn until there was no longer enough light to see a target. One wealthy sportsman would send his guides out hunting and have them fill barrels full of all the geese and ducks for shipment to his friends.

Fortunately attention was attracted to the eighty square miles of marsh formed as the result of a ditch dug by two girls. This marsh was a favorite wintering ground for the blue goose. From their breeding grounds on Baffin Island they fly to James Bay, and from there make a spectacular non-stop flight to the gulf coast of Louisiana. Much more indiscriminate shooting and the beautiful birds would become extinct. The land was bought as a federal refuge in 1935. Not only were the blue geese saved but sanctuary was provided for many types of animal life. The Canada, lesser snow and white-fronted geese were to benefit as were the dwindling deer and alligator populations of the delta.

Islands in the gulf were included in the refuge so that the nesting ground of terns and black skimmers would be protected. In addition the refuge is a favorite gathering ground for the white pelican, locally called the grand gozier. These birds like outer coastal flats so well that hundreds stay all summer instead of returning to their northern breeding grounds. Whether geese, ducks or pelicans the establishment of the refuge meant one less hazard in lives constantly fraught with danger and subject to sudden death.

As work began on the development of the refuge, men began to wonder if the interior marsh could be made more attractive to waterfowl. The greatest number of geese and ducks were always found along the coast where the most choice foods grew. One reason, it was decided, why the interior marsh didn't produce the same type of plants or other more desirable ones was that much of the marsh was rotten. Cut off from the beneficial action of fresh silt-bearing water, vegetation decayed, making the water unhealthy for fish and birds. These rotten



Photograph by Allan D. Cruckshank
Snow geese fly south to the delta when the snow flies farther North

marshes existed because the passes and bayous which supplied fresh water had become choked with logs and debris. Water hyacinth and alligator weed filled the stagnant water. A stage in the evolution of a delta had been reached. A few

dominant water courses remained and the rest had either filled in or were rapidly doing so.

Undaunted by a river which doesn't like to have its affairs managed, crews of men went to work. The log jams were

removed and waterways were cleared of vegetation. A canal was dug to one part of the marsh, which had been cut off so long from any appreciable amount of silted water, that it had subsided and was being invaded by salt water from the gulf. Mangroves and salt marsh grasses had appeared. But the regenerative action of fresh water brought in by the canal took effect. The mangroves have died and large flocks of herons, egrets and ibis perch in the skeleton trees. During the winter the ducks and geese, which had avoided the region, come in large numbers.

Paradoxically it was found that free flowing fresh water was undesirable in other situations. The myriads of ponds all over the marshes are one of the chief attractions for waterfowl. Many were filling in because a too abundant supply of fresh water meant heavy silt deposits. Trappers and hunters had dug ditches to these ponds to make them accessible by boat. Where water swept through, the banks eroded. Turbulent waters came to rest in the quiet ponds, depositing their loads of silt. Excess clear water trickled off through the marsh. To remedy this situation dams were built in order to isolate the ponds. Steel and concrete structures were out of the question. It was a relatively simple matter to cut willows, the only tree that grows successfully along the higher-pass banks, and construct crude ditch plugs using the entire tree.

Having built dams and cleared waterways, much as a farmer builds fences and tills the soil, the refuge management began an even more farmland operation—the planting of duck foods. The planting was done from a boat as the fields to be planted were submerged mud-flats. The flats and ponds nearest the coast were planted with delta duckpotato, *Sagittaria platyphylla*. Rootlike tubers form in the mud at the base of this small plant with arrow-shaped leaves. The tubers excite the ducks to about the same degree as a banana split excites a child.

This waterfowl dessert is found abundantly in only one place in the world—the Mississippi delta. It grows best on newly forming silt deposits which are submerged at least part of the year by fresh water. The refuge has much superb environment for its growth, but if salt water invades the duckpotato beds before the tubers are formed, the season's crop will be destroyed. For this reason it is necessary at times to supplement a depleted stock with new plantings.

Salt water, on the other hand, will yield beneficial results when ponds choked with alligator weed and water hyacinth are invaded. These pests are killed and when the pond becomes fresh again, duck foods have a chance to grow. This is the time to plant such foods as banana waterlily, *Castalia flava*, a type of lily which yields excellent results. The beauty of its yellow blossom is lost on the creatures of the marsh, but its bananalike tubers are eagerly consumed by ducks. Needless to say, the refuge crops need no harvesting as thousand of hungry geese and ducks are more than willing to do the job.

Although these activities on the part of the Fish and Wildlife Service improved the marsh immensely and made it an even richer wintering ground for geese and ducks, the river has the final say as to which creatures shall dwell in the marsh it created. Usually during the winter and spring the Mississippi is high and the refuge marshes are inundated by fresh water. During the summer the river falls. No longer do winter rains and melting snows from the Appalachians to the Rockies keep it high. Salt water from the gulf begins to make the marsh brackish, but no matter how low the Mississippi becomes, the usual heavy rainfall, characteristic of the delta, keeps the marsh relatively fresh. Yet the fate of thousands of small fur-bearing animals as well as the appearance of geese and duck in the fall depends on when and how much the river rises and falls.

For instance, the higher the water the better it is for muskrats. They are able to cope with all seasonal changes short of a hurricane. It is their enemies which suffer during a prolongation of high water. The omnivorous raccoon is a number one enemy, robbing the nests of young. He is also the abomination of the trapper because of the countless hides ruined when he makes prey of muskrats helplessly caught in traps. During high water the 'coon seeks safety in the willow trees, but cut off from his feeding grounds, he is likely to starve. The water moccasin is another muskrat predator, having a taste for the young. This venomous reptile would appear perfectly adapted to an aquatic environment. But if unable to occasionally sun itself on some dry log, it develops sores and dies. Lengthy periods of high water substantially reduce the water moccasin population. There is no one to lament the departure.

Strangely enough, another muskrat enemy is the ant. Life finds form and shape in prodigious numbers on the delta. Nothing, perhaps, is more abundant than the tiny ant. They swarm all over the marshes and by sheer numbers are a menace to nesting birds and even deer. Fawns have been found in a weakened condition, covered with ants. They often make their nests in muskrat houses. Sometimes when such a house is examined the bones of muskrat young will be found, gleaned by ants. Their numbers, fortunately, are considerably reduced during prolonged periods of high water. A hurricane is particularly effective. The infested muskrat houses and rotten logs are swept away carrying millions of ants to their doom.

Otter and mink, on the other hand, prefer low water as their supply of fish is more readily obtainable. The same is probably true of the alligator. The deer prefer low water conditions for raising their young. Thus if the water level remains high far into the summer and the same is true for several succeeding sum-

mers, the little muskrat, surveying the great marsh from his domed hut, could, if he had the intelligence, call himself king. But being extremely prolific his reign would be short-lived. The animals multiply to such an extent as to eat themselves out of house and home. Not only would they eventually suffer but the geese and ducks would feel the pinch immediately, as both feed on the same food plants. Realizing this, the refuge manager estimates the number of muskrats on the marsh and issues permits to local trappers with whatever limit seems best in light of next year's population and possible damage to waterfowl food. The government shares in the take and thus during a good season the refuge more than pays its way.

The muskrat has no wings and must stay even if he finds the marsh teeming with water moccasin, 'coon and ants. If the geese and ducks come in the fall and find things not to their liking, they can take one look and fly away. This might very well happen if their favorite foods have been killed by salt water. The geese feed chiefly on the rhizomes or rootstocks of three square, *Scirpus americanus*. As the geese dig up the plants, ducks follow in their path to glean the seed which grows near the tip of the triangular bayonetlike stalks. Although a hardy plant and fast grower, it cannot stand too great a degree of salinity early in its growth. Thus if the Mississippi drops unusually early in the spring, allowing the salty gulf to encroach on the borders of the marsh, the three square bulrushes as well as the banana waterlily and the delta duckpotato will have a poor season. Consequently the majority of the geese and ducks will range along the gulf coast, searching for more favorable feeding grounds.

But even if the Mississippi had stayed high through a good part of the summer, allowing optimum growth of the choice duck-food plants, the geese and ducks might still find conditions unsuitable. The river might have suddenly dropped

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during the summer and continued low throughout the fall and winter. This would have no ill effect upon the mature growth of the various duck-food plants, but it would mean that the geese and ducks couldn't gain access to them. One may begin to suspect that the birds are unusually cranky or hard to please. But it is a most difficult undertaking, for instance, for a clumsy goose to enter a dense stand of three square, high and dry, with no water available to carry him into its midst. Thus a combination of unfavorable water levels or even a prolonged low water stage during either the spring or fall will send the geese and ducks flying elsewhere, and perhaps into the range of waiting hunters.

With ideal water conditions throughout the year the delta refuge can witness some of the most spectacular waterfowl concentrations to be seen anywhere, even when everybody else is complaining about the scarcity of geese and ducks. Half a million blue geese may spend the winter on the refuge. Possibly ten thousand lesser snow geese will share the feeding grounds with them. Baldpate, blue-winged teal, gadwall and pintail may number from fifty to one hundred thousand of each species. Geese and

ducks of other species will vary in only somewhat more modest numbers.

The delta marshes offer a complex picture, indeed, with fluctuating water levels continually changing the balance of nature. Few species can keep their numbers constant under such conditions and the struggle for existence is acute and precarious. Nature, however, has endowed this region with the richest soil our states can produce and a climate almost tropical. Life surges forth with great exuberance and takes advantage of the unlimited food supplies. One species is triumphant for a day or a year, but another is barely lingering in some remote corner of the marsh, waiting for the favorable conditions that will bring it forth in prolific numbers such as will crush other forms.

Man has a secondary role as compared to the forces of the river, but it has been demonstrated that he can alter conditions effectively enough to mean the failure or success of a species. It is encouraging, indeed, that man has thrown his weight in support of the blue goose, the white pelican and to many other beautiful and unique forms of life, in the creation of the great Delta National Wildlife Refuge.

Black skimmers nest on the Gulf islands that are part of the refuge

Photograph by Allan D. Cruickshank



The bird life of the Philippine Islands is rich and varied, as the author found when the Navy took him into active adventure in an ornithologist's paradise

A SMALL dark form sat motionless deep in a Philippine jungle thicket. Carefully, I stepped first to one side, then to the other, and finally discovered an opening through which I might better view the vague shape. On readjusting my binoculars I found myself staring directly into the glittering eyes of a glossy black and white bird.

"Shama thrush, *Kittacincla* something-or-other," I mumbled half aloud.

"Is it a Jap?" whispered a soft voice in broken English.

Startled, I turned to face a half-naked Moro who bared his betel-stained teeth menacingly and clutched the impatient and bloodthirsty barong which hung at his side.



I hastened to assure him, "Oh, no! It's a bird."

"A bird!" he exclaimed with incredulity. "You are looking at a bird?" He gazed at me in unveiled awe for a moment. "Why?" he asked with patience which was obviously strained, "Why are you looking at a bird?" He spoke in that cajoling manner which is usually reserved for recalcitrant children and ravaging maniacs.

"It's my hobby," I explained, "I like to look at birds."

He considered the statement for a few seconds; then he shook his head and walked away.

Slightly annoyed but unsurprised, I returned to my study of the shy little thrush. I long had been accustomed to such an attitude. A collector of match folders, a flag-pole sitter, or a whist fanatic is understood and looked upon by his fellowmen as a perfectly normal being. But just show them a bird student and they waggle their heads in amazement exchanging those irritating winks which say so plainly, "What kind of an eccentric is this?"

As I watched the shama, I heard a noise behind me and turned around to find that my boy-with-the-barong had returned. This time he was not alone for with him he had brought a dozen friends to enjoy the spectacle. He smiled knowingly at his companions and asked me again, for their benefit, "You are looking at the bird?" When I had answered, he began to chatter excitedly in his native *chabacano* dialect. The expression on his face made the meaning of his words obvious. "I told you so; you have to see it to believe it!" He was triumphant!

Feeling somewhat akin to a blue-rib-

LAND of the CALAO

by Ken Stott, Jr.

Illustrations by the Author



bon sow at the county fair or a flaming Niagara Falls in a fireworks display, I considered returning to camp for the day. This was not the only occasion upon which bird study had involved more trouble than it seemed worth. There had been the time in Sinaloa when government detectives removed me from the train as an espionage suspect; another time when San Diego M. P.'s misinterpreted my motives as I watched swallows nestbuilding on the underside of a railroad bridge; that horrible day on the troop transport when, in the excitement of seeing my first Hawaiian storm petrels, I dropped a burning cigarette down the neck of a commander who stood on the deck below; and the afternoon on Samar when, as I attempted to get a better view of a pair of cockatoos perched in a jungle tree, I nearly backed into a cobra.

Such experiences have a most discouraging influence and, as I watched the group of fascinated Moros, I was sorely tempted to yield to it. But here I stood in an ornithologist's paradise! Before me lay a thousand opportunities which might never come again and I felt almost morally obligated to utilize every free moment to its best advantage. At any time military orders might arrive to send me on to some other area or even back to the States, and there was still much to be seen in the Philippines!

Nowhere else in the world is there an area of equal size richer in avifauna. Contrasting habitats and geographical affinities to Malaya, China, the Dutch East Indies, and Australia serve to provide the Philippines with a prodigious and diverse assortment of birds. Taxonomists have described more than 750 species and subspecies indigenous to these islands. The average ornithologist upon arriving in the Philippines finds himself utterly at a loss to identify the birds he sees. He is indeed fortunate if he can place them in their proper families or even in the correct orders for, unless he is already familiar with the birds of some part of the Old World tropics, many of their families and orders are strange to him. Best preparation for such a novice is that which he can give himself in either a natural history museum or a well-stocked zoological park where he can familiarize himself with representative species of most bird groups.

It was straight from a job in the San Diego Zoological Garden that I went to the Philippines as a member of a U. S. Naval epidemiology unit. There I found countless creatures identical with or related to birds I had known in the zoo, but there were many more which, in the flesh, were completely new to me.

When first I set foot on Philippine soil my ears were greeted with a con-



The coleto or rose-wattled mynah appears to be extremely curious

fusion of avian sounds. Among them, I found but one which seemed familiar, the rattling laughter of a white-collared kingfisher, so much like that of our belted kingfisher. During the ensuing two and a half months spent in Guiuan on the southern tip of Samar, one by one the various voices began to assume some meaning, the hearing of each bringing to mind the picture of a particular bird.

Among the birds I met first on Samar, and was later to see on islands from one end of the Philippine group to the other, was the coleto or rose-wattled mynah which seemed equally at home in garden, lowland second growth forest and mountain jungle. Its presence was always first indicated by a high, piercing call, an unpleasant sound which brought to mind the prolonged squeak of a rusty hinge.

Coletos, common about our quonset hut, were among the few birds we could always plan on seeing even during the hottest part of the day when other, more sensible creatures sought the shade of the deepest vegetation. Around places of human habitation they were shy birds, taking to flight the second anyone attempted to approach them, but in the seldom-disturbed forests of the mountain tops they seemed extremely curious, hopping through the trees to within reaching distance whenever we paused to rest.

Parrots of several species were to be found within a few hundred yards of the village of Guiuan but, unlike the macaws and Amazons of our American tropical forests, they were silent and shy. In Guiuan forests, just before sundown,

a silent observer stands a good chance of seeing pairs and trios of both Philippine green parrots and the lovely racquet-tailed parakeets as they leave the security of their day-time roosting places on foraging expeditions. Unlike many of the American parrots which, while feeding, can be heard for miles as they screech and squabble, the green and racquet-tailed species eat in comparative silence and even when frightened into flight make no vocal sound. Hanging parrots, highly-colored birds of love-bird size, are almost impossible to find as they hang in the trees. Even when they are flushed, only a glimpse of their beauty is afforded as they disappear in rapid flight into the depths of the jungle.

Such behavior led me to believe that all Philippine parrots must suffer from persecution complexes but my premature conclusions were doomed to be knocked into a cocked coolie hat by an encounter with a blatant exhibitionist. I was walking through a dense coastal forest on Manicani, a small island which lies four miles from the west coast of Samar. It was mid-day and the jungle steamed in breathless humidity. Birdlife seemed non-existent and only the sporadic pulsating song of a cicada broke the oppressive silence. An hour had passed since last I had seen a single living creature. Was this an enchanted forest and devoid of animal life?

As if in answer, a strident voice shrieked at me from above. There on a bare, twisted branch not twenty-five feet from the ground sat a gleaming white cockatoo which eyed me with considerable indignation. Slowly he shifted from foot to foot and cocked his head to one side that he might see me better. He squawked from time to time and with each harsh blast raised his broad and stubby crest. Eventually he decided I was up to no good and certainly of no further interest, so off he flew. How conspicuous and incongruous he appeared, a great white parrot against a background of tropical verdure.

I later found cockatoos to be abundant birds throughout much of the Philippine region and among the easiest birds to observe. Their instinct to flee from danger seems always to be far outweighed by an innate curiosity. Upon each encounter, the bird (or birds) would invariably examine me with obvious interest before taking to flight. Sometimes their attentions proved decidedly an annoyance for upon occasion flocks of cockatoos would accompany me through the forest, screaming a warning to all other furred and feathered creatures which might be near.

Southern Samar and the nearby islands have much to offer the ornithologist: babblers, bee-eaters, swiftlets, several species of kingfishers, wood swallows, highly colored Old World flycatchers, several species of sun birds, bulbuls, flowerpeckers, drongos, hornbills, nightjars, hawks, eagles, kites, broad-billed rollers, fruit pigeons, wood and turtle doves, herons, egrets and bitterns, land rails and scores of others. I had only begun to feel at home in their midst when our epidemiology unit received instructions to move on. The change was not an unwelcome one for our orders bore a name which had long intrigued me, "Zamboanga, Mindanao."

As the starboard wing of our plane dipped low, the scene which lay below us offered a tantalizing preview. The town of Zamboanga was situated at the very tip of a mountainous peninsula. To one side we could see the waters of the Celebes Sea and, on the other, the Sulu Sea. Coconut palms bordered the shore except where nipa and mangrove swamps broke its regularity. Inland, bamboo-covered foothills rose in terraces to form steps to the uncharted bejungled mountains beyond. As I looked at them from above, I could scarcely wait to penetrate these highland forests.

My first opportunity was not long in coming for we had barely established our Zamboanga laboratory when we received orders to test the waters of the

Tumaga River, from which the city obtains its water supply. To do a thorough job of it, we found it necessary to collect water samples from the river not only where it flowed through town, but also in the foothills and above in the mountains. The required samples were collected and at the same time an astonishing number of bird notes somehow found their way into my field books.

Flame-colored trogons burst into flight at our approach and jungle fowl fluttered awkwardly through the bamboo. Malay black woodpeckers filled the air with the din of their carpentry. But of all the birds we saw on that first survey none proved quite so impressive as the hornbills which roamed through the tree-tops.

By noon we had listed three species of hornbill and each was distinct in habit, in appearance and in sound. Largest and noisiest of the three was the Mindanao rufous hornbill whose resonant calls resounded through the forest. This enormous bird, known to the na-

tives as the *calao*, has a crimson, ivory-tipped bill, above which lies a great casque resembling an inverted flatiron. Rufous hornbills travel in small flocks and occasionally join forces with groups of other species of hornbill. I later obtained a living specimen of the rufous hornbill which proved to be as responsive and active a pet as I have known.

The second and commonest species of hornbill native to Zamboanga's mountain forests is the smaller white-headed hornbill, whose native name is *calao ee*. Its flocks sometimes comprise as many as eighty individuals and may include representatives of the larger species. The third species, called the tarictic by scientists and *culasi* by the Filipino, is a quiet little black and white bird of the mid and lower levels of the forest and is usually to be found singly or in pairs.

My zoo-training caused me to experience quite a thrill when we flushed our first fairy bluebird, for this lovely creature is much in demand by zoos and only rarely exhibited. However as the day proceeded and we saw one after another, my excitement dwindled and I felt just a little disillusioned. The bird had become commonplace for nearly every pack of macaques had its "monkey guard" (a literal translation of the native name for the black-mantled fairy bluebird).

During the three months which followed, scarcely a day passed that did not offer excuse for some new entry in the book. Trips into the mountain forests constituted by far the most exciting adventures, but brief excursions through the lowlands and even within the limits of the town itself invariably proved fruitful. Clouds of weaver-finches inhabited the vegetation about our hut and in our papaya thicket lived a pair of white-



The monkey-eating eagle, monarch of all Philippine birds, is a prized rarity in zoos but may be seen without great difficulty in the mountains above Zamboanga.

breasted swamphens whose staccato calls often awakened us at night. Cattle egrets and herons of a dozen other species overran the neighboring marsh.

Among the lowland birds in and around Zamboanga, bee-eaters are perhaps the most easily observed for they have little or no regard for mankind. The brazen green-headed bee-eater makes his home in the ricefields and may be seen sitting on fenceposts or in great flocks dusting in the roadbeds unmindful of passing traffic. The smaller, more handsomely colored chestnut-headed bee-eaters prefer the marshy coastal forests where they roost in trees. During the day they fly like a swarm of angry bees about the particular tree they have selected as a roosting place and drop, as do nesting terns, to within a few inches of any human being who dares to venture near.

Without a doubt, the entry in my field book which gave me the greatest pleasure to record was that which reads, "monkey-eating eagle." We had seen the monarch of all Philippine birds. As we had stumbled through the jungle earlier that day, it had soared above us on broad wings, its filmy crest expanding slightly with each wing beat. I had known it at once, for years before a specimen in the San Diego Zoo had impressed me with its might and size. Although the species is generally considered to be a rare one, such did not seem to be the case in the mountains above Zamboanga. There the natives were quite familiar with it and upon request had succeeded with little effort in showing it to us.

Shortly before leaving Zamboanga, I was invited to make a brief trip by cutter to the Sulu Islands which lie scattered like a broken string of emeralds between Mindanao and northeastern Borneo. Terns and red-footed boobies soared over the ship as it sped across the smooth waters of the Sulu Sea and from time to time a white-breasted sea eagle would serve as temporary escort. As we neared Jolo, Sulu's island capital, Brahminy kites came out in a lazy swarm to greet

us in hopes that garbage might be thrown overboard. As we docked, they settled down to perch gull-like on the lampposts which bordered Jolo's picturesque waterfront. Whimbrels lined the beaches and inland we found larger flocks of cockatoos than any I had seen before, some so great that as they hovered over the forest they resembled flurries of gigantic snowflakes.

Upon returning to Zamboanga, I found the laboratory crew involved in the process of packing equipment and personal gear, preparatory to making a transfer. This time we boarded an LST which wandered leisurely from island to island until it reached Luzon, in the northern end of the archipelago. On this, the largest of the Philippines, we stopped only at Olongapo on Subic Bay and for a few days in the ruined city of Manila. Many of the birds we found there were now old friends but some were new. Conspicuous were the vociferous crested mynahs, importees from China which have established themselves with a vengeance. We saw them first in the outlying fishing villages and later found them to be just as numerous within the confines of the busy Intramuros.

Our time in Manila passed rapidly and far too soon we were headed south and east on our way to the Marianas. The LST carried us through the San Bernardino Strait which separates Luzon from the northern tip of Samar and, just as it had earlier served to introduce us to the Philippines, the island of Samar now offered us a final glimpse of that wonderful jungleland.

As I write, the Philippine archipelago lies several thousand miles away. Yet here in the zoo I can hear again the sonorous call of the hornbill, the bickering of nesting cattle egrets and rufous night herons, the piercing screeches of feeding cockatoos and the muted crow of the jungle fowl—all constant reminders that not so long ago I firmly vowed to go back to the Philippines. And some day I shall!

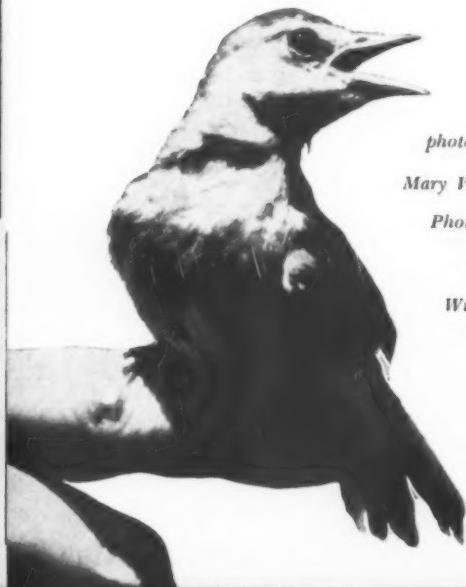
"FOOD! FOOD! FOOD!"

*Baby birds shout for it—
here's what to feed them*

By Josephine V. Willis

HE who would befriend orphaned or injured wild birds must pay careful attention to their dietary needs. These are not vagabonds to be queued into a bread line, but patients whose plight entitles them to intelligent consideration. Canary seed and crumbs are not enough; egg, dog food, baby chick feed, nuts, corn meal, dried and fresh fruits, greens, hard fat, and seed—especially millet—provide the essential elements of a bird's diet. Love for birds must be liberally mixed with the food and care.

My experiences as an amateur here



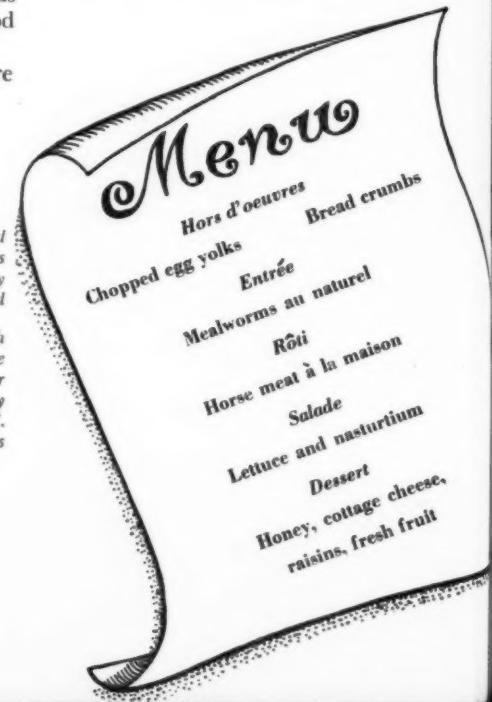
*Bird
photographs
by
Mary V. Hood*

*Photograph
of the
author
by
Wilber F.
Willis*

in Southern California have taught me that synthetic feeding must be carefully studied to render it a successful substitute for natural food, which (in the case of nestlings) is usually predigested. Young birds should be handled as little as possible and not fed too much at a time. Feedings should be frequent, however, at least every fifteen minutes during daylight hours. Bird babies are much like human babies, demanding all the attention they can get; but regularity and moderation produce the best results in health, growth and feathering. Kindness overdone can kill a nestling.

My basic food for very young nestlings, other than hummingbirds, consists of equal parts of finely mashed yolks of hard-boiled eggs and finely sifted bread crumbs, slightly moistened (not mushy) with milk. This I feed on the tip of a medicine dropper or an improvised narrow wooden "spoon."

In about a week, most birds may have, in addition to the egg mixture, finely sifted or mashed food, as nearly like their natural food as possible: corn meal and crushed nuts for seed-eating birds, worms or meat for insect-eaters, in gradually in-





creasing amounts. Like human babies, they should be encouraged to feed themselves as soon as they show any aptitude. Calcium for feathers and bone building and vitamins for general vigor, which occur in the wild food eaten under natural conditions, must also be supplied to hand-reared birds.

This fact was brought home to me through my experience with Keet, a "lost" Nyassaland love bird, found in a

parkway nearby, in 1941. Her back was bleeding from shoulder to shoulder.

After vain efforts to cure the trouble I took her to a local bird hospital, where after two weeks they had healed the raw spot, but still no feathers grew there. They suggested liberal feedings of lettuce. Presently pin feathers began to show, but as fast as they appeared, Keet pulled them out, impelled by an itchiness, as we learned by watching her. A medicated powder did no good.

A study of the subject revealed that birds native to South Africa are particularly subject to scurvy, a calcium deficiency trouble. Limes, rich in calcium and vitamin C, a natural antiscorbutic for man, could not be used for my bird.

One day, having no lettuce, I substituted a nasturtium stem with flowers, green seed pods and leaves. Keet attacked them with vigor in that order of preference. From then on she steadily improved in health and color, and stopped pulling out feathers. Further study showed that nasturtium and watercress, both members of the same mustard family, are rich in calcium and vitamins A and C, with some B₁, all sorely needed. With an occasional sunbath for vitamin D, and a little cottage cheese added for protein to the regular seed food of the love bird, we rebuilt Keet's vitality. Dandelion blossoms and the juice in the long stems also seemed to appeal.

This knowledge, gleaned over a three-year period, is now being used in treating our own patients and those of a local thirty-year old bird hospital.

Finely chopped leaves of the two calcium plants are added to the diet of our sick and orphaned birds the second week, when I find the basic food needs changing in many respects. For instance, most seed-eaters need fine gravel and charcoal, crushed seed, chopped greens and fruit, mealworm or other insects.

I learned much, not hitherto recorded, with three California woodpeckers, brought to me when two of them were eight and ten days old, respectively, and

the third, naked, hungry and most noisy of the trio, not more than two or three. The runt looked like Donald Duck, quawked worse than Donald Duck, and so was named Donald.

I was disconcerted by the enormous pits they showed me to feed, and the squawks they emitted. From five o'clock in the morning till nine at night whenever they saw or heard me, they called "Food! Food! Food!" and I fell for it every time. All this was done, of course, in the hope of getting photographs and new knowledge. They were not expected to survive more than a week or two.

At length I began to realize that mama woodpecker would not be so gullible as to spend every minute feeding the babies, so I shortened the time to regular hours, and collected dividends in sleek, brilliant plumage and very healthy birds.

The diet on which they thrived thus was a mixture of dog food and my basic food, together with a little corn meal (simulated acorns), or crushed peanuts. Later I raised mealworms, each bird finally receiving 12 daily. The woodpeckers were fond of milk, and enjoyed it from a medicine dropper long after they were old enough to drink by themselves. They also preferred hand feeding when they were really "grown up," and

we spoiled them.

We provided a fresh cut trunk, which they used only for perching until dryness cracked it and encouraged the storing of food. Boy Scouts brought acorns, and the birds enjoyed caching them everywhere. Their long tongues would dart out to catch insects flying through the cage, or mealworms held at a distance from them.

On Donald's first birthday anniversary, he visited a Sierra Madre School where a group of Brownies was to be entertained with a talk on birds. The last specimen, a beautiful egret, was being discussed, when a squawk from behind a corner screen caused a great commotion. Donald had talked out of turn! The lecturer calmly quelled the excitement by saying, "Why, girls, that is just the next speaker!" And then Donald amused the children no end, darting out his tongue for mealworms and peanuts.

Donald always enjoyed a romp just as children do at bedtime, darting from one corner to another in his roomy cage until we were both tired. When ready, he would settle himself quietly where I could place my hand on him and put him to bed on the wall of a carton, hanging onto hardware cloth, and "hush" him for the night.

The three thus adapted themselves to hand feeding and human care and developed into beautiful specimens worthy of the study given them later in Griffith Park Aviary.

The baby hummingbird, Anna, presented a different problem. She was $1\frac{1}{4}$ to $1\frac{1}{2}$ inches long, weighed just 40 grains, and was unable to rise on her feet for a week. The first food I gave her was a syrup of equal parts of sugar and water, fed with a medicine dropper. At about ten days she got her first protein. Desiccated dog food was *very* finely sifted and thoroughly mixed with the syrup, but she absolutely scorned the stuff! Knowing from past observations that hummingbirds are partial to red, we added red vegetable coloring to the



"ugly brown syrup" which seemed to have no appeal. Thereafter, our Anna actually guzzled the pretty "red honey," which she soon learned to take herself, projecting her tiny tongue into a dropper attached aslant the side of the hardware cloth cage. At about a month, she learned to hover under honey-treated blossoms hung from the roof of the cage. Now we knew she would be able to fend for herself.

Another orphan was Aurelia, a week-old Bullock's oriole, found wobbling about under a rose bush. I put her on my basic food for a few days, then added dog food, bread crumbs, sand and charcoal (all very fine), and finely cut raisins, milk and cottage cheese. This last was so much her favorite *entree*, that she often refused other food until the cheese was first provided. She enjoyed as a special tidbit a daily slice of sapota, a specially vitamin-filled fruit, a cherry and a bit of apricot; she also relished long sprigs of celery gone to seed and nasturtium leaves.

A three-weeks old orphaned female black-headed grosbeak committed to my care had already had a start, and was put on the regular adult food, except that she ate much more fruit. Three weeks later we released her in the nearby park sanctuary. When placed on the trail, she seemed lost and sat motionless. Much to my surprise, I could touch her, and I picked her up and placed her on the

back of the park bench where my husband sat. Up to this time she had allowed none of us to touch her. After a brief inspection she edged toward my husband, made her way up his sleeve and onto his shoulder, spied his ear and angled up to try a nibble!

Injured birds are more difficult to care for than nestlings, being mostly adults with fixed habits. Frequently they need only immobilization of broken bones and proper food with an abundance of calcium and vitamins to hasten recovery. A speedy release is desirable, for adult wild birds do not readily adjust themselves to captivity, even for a brief first-aid session and recuperative period.

An interesting case was a yearling road-runner, driven into our residential district by mountain fires which had destroyed the chaparral habitats. One toe was crushed, and all tail feathers but one were pulled out. Barney, as my husband named him, was a handful, with his angry eyes, his death-dealing bill and his general resentfulness. He wanted snakes, lizards, frogs, tarantulas, etc., for food. I tried to bribe neighborhood boys by offering them a look at Barney if they would bring me any of these. But since none of the items was forthcoming, I had to improvise again by making synthetic lizards of horse meat, cut in strips about eight inches long and the thickness of a small lizard, and hung over a branch in my bird's cage. A breeze some-



times set the strips in motion. Barney fell for the "lizards" and enjoyed his stay of more than a month with us.

I was careful not to get too close to his powerful bill, which we saw in action one morning. He had left a surplus lizard on his log the night before. Horse meat, having no fat, becomes hard and dry overnight, and Barney found a tough breakfast; but he seemed to know the answer, slamming his lizard down hard on the floor of his cage, first one end and then the other, until his meat was tenderized to his own taste. And then we watched the eating rite: first he took a gulp of about two inches, letting the rest hang from his bill; then another gulp, swallowing a little more; and for the rest of the lizard, he jumped high in the air and plopped down hard, jolting the remnant down his throat.

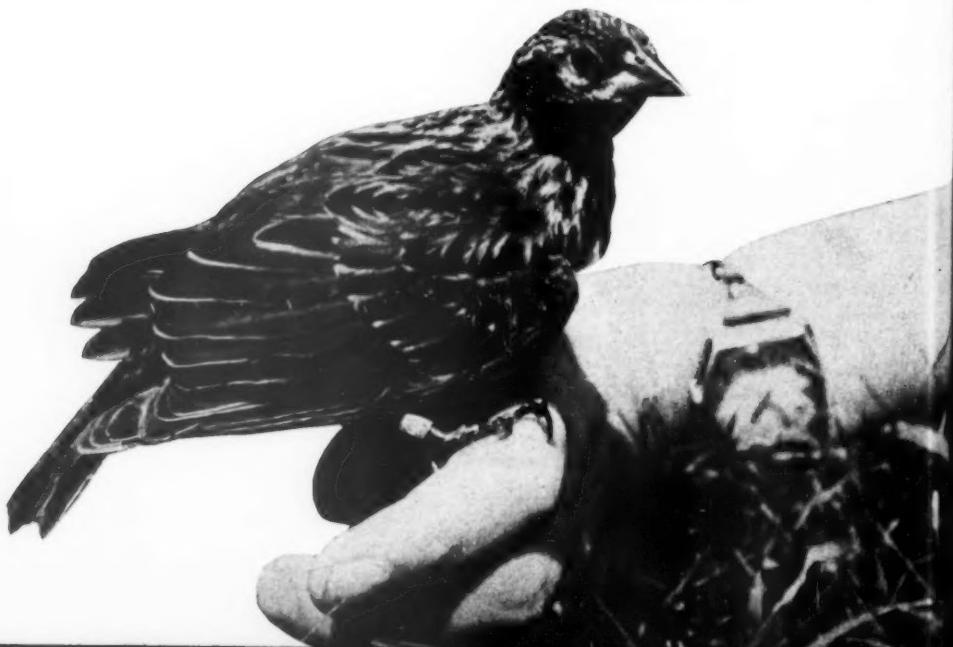
When a friend banded this bird, I had the unusual experience of holding Barney, who was so indignant at the insult to which he thought he was being subjected that his tongue, about 3 inches long, darted in and out like a snake's tongue; and we saw it had two pairs of barbs which accounted for the jerky way of consuming prey. Whether they are of bone or cartilage, I can't tell. Then too, his blood pressure rose causing the

orange-yellow and blue skin patches behind the eyes to change to their deepest shades.

Barney had had no breakfast that morning, and after the banding he was so irate that he refused food for about three hours. Sensible bird! He knew instinctively that it is unwise to have food immediately after a violent temper or great excitement. In the time he was with us, on a purely meat diet, Barney recovered all his tail feathers; he was then taken to Park Zoo Aviary for further observation where he had more room.

I have had many birds of different species brought to me for care, but the foregoing are among the unusual cases; the others were fed in accordance with what my experiences with these taught me. Local foods may be substituted for those mentioned here, if of like vitamin and mineral content.

I always keep my orphaned or injured birds in individual cages—the equivalent of private hospital rooms—and release them as soon as they are able to fend for themselves, remembering that these wild birds belong to the state, and even to care for them when necessary requires a permit, which is canceled when the bird is released.



“Behold, the fowls of the air”

by J. J. Murray

A minister discusses the Bible philosophy of nature and identifies some Bible birds. This is a chapter from Dr. Murray's new book, *Wild Wings*, to be published in March.

*Drawings by Robert F. Seibert
from Egyptian wall paintings*



*"For, lo, the winter is past,
The rain is over and gone;
The flowers appear on the earth;
The time of the singing of birds is come,
And the voice of the turtle is heard in
our land;
The fig tree putteth forth her green figs,
And the vines with the tender grape
Give a good smell.*

IT would be difficult to find a lovelier picture of the coming of the spring-time than this description by the writer of the Old Testament poem. *The Song of Songs*, which is called Solomon's. Here is the feel of the wakening earth; here is a sensitiveness to each detail of the vernal landscape; here the consciousness of kinship between the changing moods of nature and the responsive emotions of the human heart.

Were it possible to ignore its religious significance, the Bible would still be high literature: dignified, vivid, noble. That is clear not only in the original Hebrew and Greek, but also in the vari-

*Arise, my love, my fair one, and come
away.
O my dove, that art in the clefts of the
rock,
In the secret places of the stairs,
Let me see thy countenance,
Let me hear thy voice,
For sweet is thy voice,
And thy countenance is comely."*
(Song of Songs 2:11-14)

ous versions, for the universal quality of this book is evidenced by the way it bears translation into the languages of other nations and other times. This is due in part to the fact that most of the material of the Bible, particularly in the Old Testament and the Gospels, is literature of the unsophisticated type. It is primitive and direct, in close contact with the elementals of nature and the simplicities of humanity. Much of this literature is of the soil; it comes to us through men who are still close to wind and rain and sun, weather-wise, and fellows of the folk of air and field. Its writers in the main are village men: even for its aris-

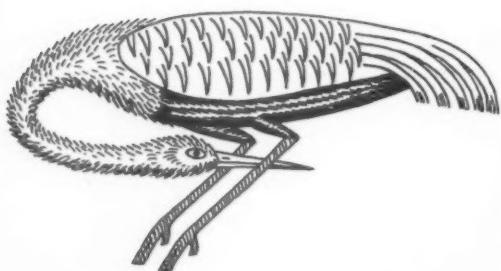
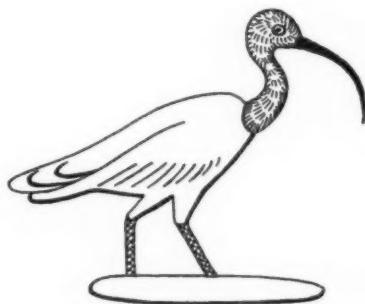
tocrats like Isaiah it is not far over the city wall to the open spaces. There is a direct understanding of nature, a bookless knowledge of her ways and of her children.

Nature is alive to these men. They know little, in the complex chain of natural events, of second causes. To them nature is alive because nature's Creator is active in her phenomena as well as in her foundation. He is not an absentee landlord in a universe which only knew Him long ago; He is One "who maketh the clouds His chariot: who walketh upon the wings of the wind: . . . He sendeth the springs into the valleys, which run among the hills. They give drink to every beast of the field: the wild asses quench their thirst. By them shall the fowls of the heaven have their habitation, which sing among the branches" (Psalm 104:3, 10-12). So says the writer of that most beautiful of all nature poems, the 104th Psalm.

Throughout this book there is a sympathy with nature and a feeling that the Creator Himself has a concern for every living thing that has come from His hands. One of the laws of Deuteronomy, for example, directs that, "If a bird's nest chance to be before thee in the way in any tree or on the ground, whether they be young ones, or eggs, and the dam sitteth upon the young, or upon the eggs, thou shalt not take the dam with the young: But thou shalt in any wise let the dam go, and take the young to thee; that it may be well with thee, and that

thou mayest prolong thy days" (Deuteronomy 22:6, 7). It has been remarked that this seems to ornithologists an inconsistent rule; but is it not a concern for the loyalty that makes the dam stay near its young at the risk of its own capture, and a recognition of the fact that the dam can live without the young but not the young without the dam; and is it not also a sound conservation measure for the preservation of the brood stock?

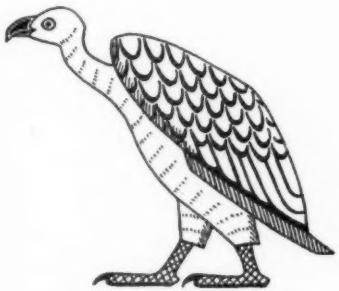
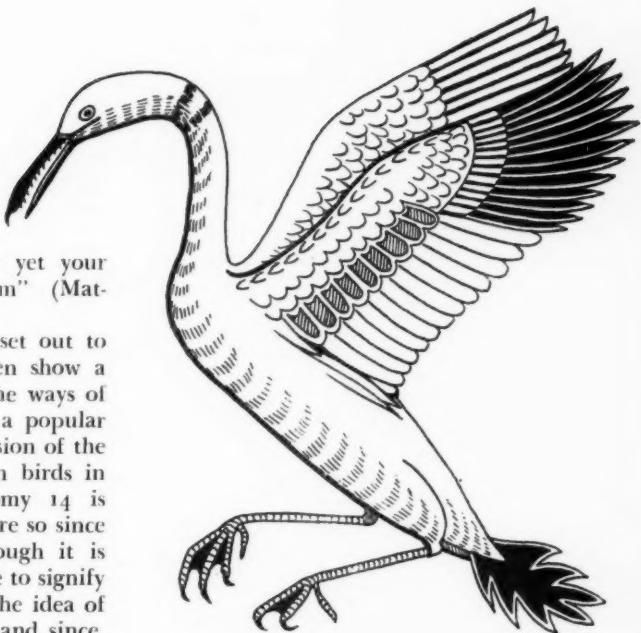
Centuries later, the Son of Man, who more than any man bore upon his heart the weight of mankind's woe, had thought for the infinitesimal poignancy of a sparrow's fall. It was in trying to give to harassed and hurried human beings a sense of trust in life that the great teacher said, "Are not two sparrows sold for a farthing? and one of them shall not fall on the ground without your Father . . . Fear ye not therefore, ye are of more value than many sparrows" (Matthew 10:29, 31). He who stands back of all



things He has fashioned, Jesus tells us, is still concerned about each created thing, no matter how small or how obscure. At another time He who, homeless, had to say, "Foxes have holes, and birds of the air have nests; but the Son of man hath not where to lay his head" (Luke 9:58), could use the birds to counsel his followers against anxiety about material things: "Behold the fowls of the air: for they sow not, neither do they

reap, nor gather into barns; yet your heavenly Father feedeth them" (Matthew 6:26).

The Bible writers did not set out to be scientific. While they often show a surprising understanding of the ways of nature, they were writing in a popular way. For that reason the inclusion of the bat in the list of the unclean birds in Leviticus 11 and Deuteronomy 14 is quite understandable; the more so since the Hebrew word *oph*, although it is nearly always used in the Bible to signify bird, has as its root meaning the idea of a winged creature in general; and since, further, the bat is named at the end of the list of birds, as a transition between



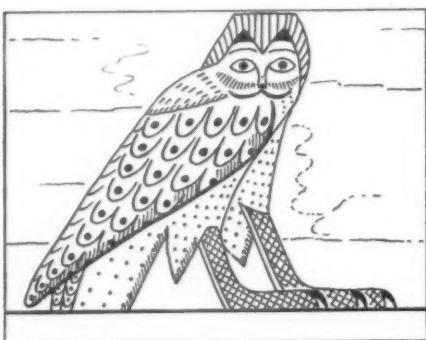
this group and that of the insects. In I Kings 4:33 we are given the simple zoological classification of the Hebrews, when as indicative of the wisdom of Solomon it is said, "He spake also of beasts, and of fowl, and of creeping things, and of fishes."

Since the Hebrews had little or no scientific nomenclature, it is often difficult to identify particular birds mentioned in Bible passages. The popular

King James Version of 1611 is not at all dependable in this respect, while even the American Revised Version is not a great deal better. Where, for example, in Isaiah's prophecy about the destruction of Edom, the King James Version reads, "the cormorant and the bittern shall possess it" (Isaiah 34:11), and the Revised Version calls the same animals pelican and porcupine. Canon Tristram, authority on the natural history of Palestine, thinks that the Revised is correct in the first and the King James in the second of the pair. As a further indication of the difficulties of zoological translation, another word in that same verse in Isaiah is translated owl in both the Authorized and Revised Versions, but the Greek Septuagint and the Latin Vulgate took the word to refer to the ibis, while some modern commentators think the bittern is the bird in question. In many cases it is impossible to determine the correct translation.

As to birds of prey, little distinction is made by the Bible writers between

those which normally eat fresh meat and those which feed upon carrion. For instance, in the much-quoted saying of Jesus, "For wheresoever the carcase is, there will the eagles be gathered together" (Matthew 24:28), the reference is not to true eagles but to vulturine birds, the term probably being used generally but with special reference to the great Griffon vulture, *Gyps fulvus*. Dr. Frank Chapman has said that some



twenty-five of the larger species of the birds of Palestine are mentioned in the Bible. In all, well over 350 species of birds are known from the Holy Land.

For small birds, the Bible writers usually have only general terms, there being no particular interest in the finer distinctions of natural history. When Jesus speaks of sparrows he probably has no particular species in mind but means any and all of the smaller birds seen around the villages. The Greek word *strouthion* in these passages is simply the diminutive of *strouthos*, the word for bird. It is interesting to note that the one bird known in common by the children of Nazareth two thousand years ago and the children of our time and country is the English sparrow, which indeed is not a sparrow but a weaver-finches, and is more African than English.

A few small birds are specifically mentioned in the Scriptures. In the beautiful verse, "Yea, the sparrow hath found an house, and the swallow a nest for her-

self, where she may lay her young, even thine altars, O Lord of hosts, my King, and my God" (Psalm 84:3), the second reference is definitely to the swallow, *Hirundo rustica*, and the first probably to the house, or English sparrow, *Passer domesticus*. The turtle, whose voice is heard in the spring, is the common turtle-dove, *Streptopelia turtur*, of Europe, western Asia, and northern Africa. In the saying, "Like a crane or a swallow, so did I chatter" (Isaiah 38:14), the translation of one of these words, probably the first rather than the second, should be "swift;" the reference being to *Micropus apus*, the swift so abundant throughout Europe and northwest Africa, as well as southwestern Asia.

One matter of historical and scientific interest in the ornithology of the Bible is the fact that both the earliest migration record and the earliest recognition of the idea of migration seem to be found here. In Exodus 16:13 we are told that the wandering Israelites, on short rations in the wilderness near Sinai, were fed by enormous numbers of migratory quail, for "at even the quails came up, and covered the camp." Again, when the travelers had reached Kibroth-hattaavah a strong wind brought the migrating flocks in from the sea, the birds flying at a height of about six feet from the ground so that the people could easily knock them down. "And the people stood up all that day, and all that night, and all the next day, and they gathered the quails" (Numbers 11:31, 32). While it is impossible to fix the date exactly, this great hunting experience of the Israelites must have taken place some time around 1500 B. C.

The earliest reference to the concept of migration in all literature seems to be that in Jeremiah 8:7, in the late Eighth Century B. C.: "Yea, the stork in the heaven knoweth her appointed times; and the turtle and the crane and the swallow observe the time of their coming." The prophet, like any good preacher, pointed a moral when he

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added, "but my people know not the judgment of the Lord." Job (39:26) has a similar reference, with a similar theological significance, the date of which is much in dispute, "Doth the hawk fly by thy wisdom, and stretch her wings toward the south?"

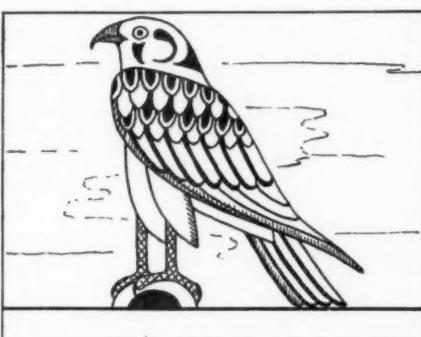
The Wisdom literature of the Bible is full of gnomic sayings of many kinds. The Book of Proverbs in particular abounds in nature epigrams: "Surely in vain the net is spread in the sight of any bird" (1:17); "As the bird by wandering, as the swallow by flying, so the curse causeless shall not come" (26:2); "As a bird that wandereth from her nest, so is a man that wandereth from his place" (27:8).

These quotations show that the interest of the Biblical writers is not scientific but popular and practical. They write about birds out of an ingenuous and sensitive interest in nature; and they use nature to illustrate their moral and religious sentiments. Where modern men think in terms of a mechanical civilization, the Bible men find their comparisons in the world of life about them. When the prophet Obadiah wishes to express his scorn of proud and ruthless Edom, he says, "Though thou exalt thyself as the eagle, and though thou set thy nest among the stars, thence will I bring thee down, saith the Lord" (Obadiah 4). Even Berchtesgaden, he would have said today, is not high enough nor strong enough to protect injustice.

In similar vein another prophet mocks at the folly of wickedness, "As the partridge sitteth on eggs, and hatcheth them not; so he that getteth riches, and not by right, shall leave them in the midst of his days, and at his end shall be a fool" (Jeremiah 17:11). The opposite idea of humble trust finds its metaphor also among the birds: "In the Lord put I my trust: how say ye to my soul, Flee as a bird to your mountain?" (Psalm 11:1); "Hide me under the shadow of thy wings" (Psalm 17:8); "Our soul is escaped as a bird out of the snare of the

fowlers: the snare is broken, and we are escaped" (Psalm 124:7).

Loneliness is vividly expressed by the poetic words, "I am like a pelican of the wilderness: I am like an owl of the desert. I watch, and am as a sparrow alone upon the house top" (Psalm 102: 6, 7); the restless, half-waking sleep of old age is pictured in the verse in Ecclesiastes, "he shall rise up at the voice of the bird" (12:4); and Jeremiah writes of desolation in words that remind us of Keats' *La Belle Dame Sans Merci*, "I beheld, and, lo, there was no man, and all the birds of the heavens were fled" (4:25). The Psalmist reminds men of the Creator's ownership in and concern for all living things by saying for Him in words that may well make a starting



point for a philosophy of conservation, "I know all the birds of the mountains: and the wild beasts of the field are mine" (Psalm 50:11).

To close, as this account began, with one of the high nature references of the Old Testament, when a great prophet would show what faith can do for the sons of men he writes, "Even the youths shall faint and be weary, and the young men shall utterly fall: But they that wait upon the Lord shall renew their strength; they shall mount up with wings as eagles; they shall run, and not be weary; and they shall walk, and not faint" (Isaiah 40:30, 31).

REVOLUTION *on the* LAND

By Hugh H. Bennett, Chief, Soil Conservation Service

PRODUCTIVE land is unlike any other natural resource. It is characterized by the element of life placed by nature in the thin mantle of fruitful soil occurring over a limited portion of the earth's surface. It is this life-producing quality that makes some lands productive, and it's the absence of this quality that makes some barren.

Productive land is further differentiated from other natural resources in that it must be maintained and used simultaneously. That is, it must be kept intact while in use. All other natural resources, with very few exceptions, must be taken from the earth—separated from it—in order to be used by man. The exceptions are certain forms of wildlife and those natural areas which, because of their aesthetic values, are kept in their original state.

Productive land is much more limited than commonly has been supposed. It occurs only on the surface of the earth, and only on part of this surface. It is not permanent. Once the fertile top-soil is washed or blown away, it cannot be restored or replaced in any practical way for generations. And what is left—subsoil—usually is far less productive, or sterile, and less stable. There are no undiscovered reserves of productive land of any substantial area.

We cannot dig deeper into the earth and find new productive soil. We cannot pump it from wells, plant it with seeds,

or dig it from mines. We must keep what we have or do without, for when soil has been washed or blown into the oceans it is not recoverable. Assorted residues of sand and gravel left stranded along streamways are of small value.

Productive land is the only natural resource without which we cannot live. We are completely dependent on it for the food we eat, except fish. We also depend on it for a very large share of our clothing and shelter. We cannot get enough to feed ourselves, or provide our clothing, from the oceans. On any large scale, hydroponics would be utterly impractical. We might conceivably turn sometime to some form of synthetic food, as pills, plus a roughage. This appears to be a fantastic extreme, still far away. And likely, if it ever comes, it will be decidedly unpopular.

To protect our source of food, then, the only sensible, practical thing to do is to protect the productive land we now have.

There is no doubt about the need for protecting productive land. Year after year, for generations, man has been steadily engaged in ruining millions and millions of acres of this basic resource. Every hard rain falling on unprotected, cultivated, or overgrazed sloping land washes additional tons of soil downslope, downstream, into the rivers, reservoirs, and oceans. Then it is lost. There is no practical way of bringing it back. And

*Photograph by Charles F. Krutch
for Tennessee Valley Authority*

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every hard wind, blowing across bare, dry soil, whether sloping or level, adds to the damage. Wind lifts the fine soil particles into the air and often develops huge dust storms that destructively scatter the substance of the land. What is left behind, frequently, is infertile shifting sand that smothers out vegetation on neighboring good land.

When the world was younger and our population much smaller, we could, perhaps stand such waste. That time is past. It is not defeatism to say the world is fast maturing and must assume now a maturing responsibility for its resources. It is not limiting the horizons of the future to say that land exploitation must stop. It is simply a matter of common sense and self-preservation. Besides saving soil and water—the two go together—soil conservation results in increased yields per acre. It is also easier and cheaper to farm on the contour than up and down hill.

Today, throughout our world, there are only about four billion acres of immediately arable land left. Not all of this land is good. The productivity of a great deal of it is only fair to medium. Some of it is poor. Yet we must count on all of it to feed a population reported to be in excess of two billion, and still increasing.

World-wide, we are already face to face with a shortage of good land. The United States is somewhat better off, from the standpoint of productive land, than most nations. Even though we have ruined more good land in less time, than any other nation in recorded history, we had the advantage of an unprecedented supply to begin with. Now we have little margin left. We still have enough productive land if we take care of it. We cannot hope to maintain our present standard of living if we lose much more; eventually if the losses should continue, the nation would suffer even more seriously.

There are about 460 million acres of really good high-class cropland left in the United States. This includes, in addi-

tion to that now in crops, about 100 million acres that need drainage, irrigation, clearing, or other improvements. This is all that is available for cropping purposes. And all but about 70 million of this 460 million acres of high-grade land is subject to erosion if it is not protected. We have no reason for complacency.

Our record shows that we have ruined, for further practical cultivation, about one-fifth of our original area of tillable land. A third of what remains has already been badly damaged. Another third is highly vulnerable. And the erosion process is still going on.

How did we get into this predicament? Why was this allowed to happen? Why didn't you hear about it sooner?

There are a number of reasons, but probably seven main ones.

First, we began losing land to erosion when the world was still young. Those were the days when there was always more land—a great deal more land—just over the hill or across the ocean. People came to regard land as limitless and inexhaustible. This deceptive idea persisted as time went by and it was probably not until the United States was settled all the way to the Pacific Coast that people began to have any real doubts about the myth of land plenty.

Second, the apparent abundance of good land for so many generations gave rise to a careless and prodigal attitude. There was nothing of any compelling nature to cause a landowner to take care of his land or have concern about maintaining its productivity. New land somewhere could almost always be had.

Third, in modern times, the leaders of thought and nations—and nearly everybody else—too often have had little or no personal knowledge or understanding of the land. They have been trained in the law, finance, philosophy, administration, military science, economics, education, or some field other than agriculture—and especially that part of agriculture having to do with the maintenance of the

base, meaning the land. With few exceptions, they have had neither the incentive nor the training to look at the landscape around them and understand what was happening. The ancient and unchallenged myth of land plenty came down to them too, through the ages, and was accepted as truth.

Fourth, too much of the land traditionally has been in the hands of the untutored and the inept. In very recent years and in a very few countries, this situation has been changing, fortunately, for the better. However, over most of the world, land is still being used by men with little specialized or adequate training for the job. Too many land users have operated on a trial and error basis and have been influenced predominantly by habits handed down from the past, whether good or bad. Some have placed greater faith in superstition than in science. Under the names of peasant, farmer, rustic, and country fellow, these individuals have been synonymous, for generations, with all that is naive, uneducated, and backward. Possessed frequently of such virtues as thrift and diligence, they have nevertheless often assumed a scornful attitude toward education and the educated. And too often, the farm has been the last resort to which men, unsuccessful in other fields, have turned. In short, the most precious natural resource on earth in too many places has habitually been in the charge of those who have had no greater qualifications for the trusteeship than the coincidence of inheritance or birth on the land.

Fifth, too few farms have produced surplus capital for the owner over a period of years. On the contrary, the farm often has been no better than a marginal or subsistence enterprise. Even in the United States, the farmer rarely has had the personal resources to undertake research or seek out technological improvements. He has generally been almost wholly dependent on outside help, from government or private corporation,





Near Duncan, South Carolina, terraces show rotation of cotton and small grain followed by lespedeza. (Photograph by Welch for Soil Conservation Service.)

to provide him with improvements in machinery, materials, and methods.

Sixth, our agricultural scientists failed completely, over bygone years, to recognize land for what it is—an impermanent



and complex resource. They considered soil permanent and synonymous with land. As a result of this mistake, both agriculture and the land suffered. Soil is but one part of land. For all practical purposes, land must be regarded in terms of all its component parts of soil, slope, climate, and susceptibility to erosion. The early scientists largely ignored erosion, paid little attention to slope, called the weather inevitable, and took soil samples right and left. In the main, however, agricultural science was not greatly concerned about the land at all. In large degree, it was more interested in the health and breeding of livestock, improvement in strains of grasses, legumes, grains and fibers; and in modernization of machinery and equipment. All of this was beneficial but it did neglect the capital stock of agriculture and the source of production—the land itself.

Seventh, in agriculture as in other enterprises we often have waited until we are sick before we call the doctor. There is an element of human nature about this and it has operated on the land. We didn't practice preventive medicine. Now we must try to cure a malady—erosion—that has gotten into our system and weakened us.

So much for history. There is little to be gained by a review of past shortcomings except as it will help us avoid similar pitfalls in the future. Today we are profiting from the lessons of the past. We know now:

1. That productive land is neither limitless nor inexhaustible. On the contrary, we have learned that the area of productive land is steadily shrinking before the onslaught of erosion.
2. That land must be expertly cared for, if it is to be maintained in a productive state.
3. That productive land must assume an ever more prominent position in the thinking of the people and their leaders. As the source of food for all people, rural and urban, it must have the regular, intelligent consideration that such indispensable wealth merits.
4. That since society as a whole depends ab-

solutely on the produce of the land for its present and future existence, society as a whole must share in the responsibility and cost of maintaining land in a productive state. The individual landowner or operator has neither the resources nor the ability to carry the burden alone—and he has control only for a lifetime.

5. That science must inevitably devote an increasing share of its attention to the problems of maintaining the substance and improving the yield of productive land.
6. That action is imperative. Time is running out between the impending pincers of an increasing population and a dwindling area of productive land.
7. That the technological key to future consideration of land development is scientific analysis of each parcel of land of any important extent to determine: (a) the type of production for which it is best suited physically, and economically, as between row crops, forage, trees, grain, or wildlife; and (b) the conservation measures, such as terracing, strip cropping, and contouring, necessary to maintain it in a permanently productive state under maximum use.
8. That practical treatment must be based on this analysis—the character of the land and its needs.

All lands are not the same. They vary widely from place to place and even on parts of the same farm or field. Every variation in the combination of soil, slope, climate, and susceptibility to erosion means a variation in the use and treatment necessary to keep the land permanently productive. Thus engineering measures are used to supplement agronomic and fertility measures wherever necessary, and vice versa, according to need, adaptability, and economic limitations.

This is the basic principle underlying the new land technology developed in the United States during the past fourteen years by the Soil Conservation Service (first called Soil Erosion Service). It is being applied to an ever increasing area of land by American farmers, acting with the assistance of Service technicians. By the middle of 1947, more than 100 million acres in all parts of the United States will be farmed in this modern con-

servation way. That is, each of the 100 million acres or more will be used according to its individual capabilities and will be treated to its conservation needs.

In the United States, land technology is spreading through a new democratic device known as the soil conservation district. The district is a subdivision of state government brought into being by a process of referendum among the landowners and operators involved. In practical application, it is a legal organization of landowners and operators within a designated area for the purpose of developing and carrying forward a mutually desirable program of soil and water conservation. Its principal advantages are in the encouragement of local initiative and in the greater strength that comes with organized numbers—farmers and ranchers working together.

In soil conservation districts the farmers themselves decide what they want to do to improve their land and water resources, and how they want to go about doing it. Then they proceed along this course, working together, and utilizing all the available facilities and services they can command. In almost every instance, districts are obtaining technical guidance from the Soil Conservation Service.

On August 15, 1946, there were more than 1670 districts in the United States, voluntarily voted into existence by the farmers themselves. These districts encompassed more than 900 million acres and approximately 4 million farms. Farmers are continuing to organize districts at the rate of approximately 25 a month.

Although democratic soil conservation districts are being employed in the United States to further the application of land technology, other nations may choose to utilize other means. A number, however, have adopted the soil conservation district method—as the Union of South Africa, Mexico, and parts of Australia.

In the long run, the overwhelming urge of mankind for survival will dictate that every remaining productive

acre be handled in such a way that it will continue to produce indefinitely. In the meantime, other factors are combining to speed up the application of technology to the land. From the standpoint of the individual and the nation alike, the development and application of soil and water conservation technology (the tool of soil conservation science) is good business. It results in greater yields and greater returns per acre for the capital and labor expended. Moreover, it maintains or improves the basic strength and self-sufficiency of individual and nation. It probably can prevent at least half the potential famines of the future.

By increasing the per-acre, per-farm, and per-nation supply of food and fiber, conservation technology can provide the basis for an improved standard of living and simultaneously reduce the hunger and discontent among peoples, which so frequently leads to discord, dictatorships, and war.

For these and other reasons, the application of land technology is certain to spread around the world, either voluntarily or by decree. By the year 1996, this world journey probably will be well advanced. By that year or before it will have accomplished changes in agriculture tantamount to a beneficial revolution on the land.

Almost certainly, productive land will have become a major factor in national and international deliberations. In all probability there would have been better international relationships if we had worked together more on ways and means of keeping land productive.

Production in the agricultural areas of the world will be more diversified; there will be pronounced increases in the acreages devoted to livestock and trees.

Agricultural production will be restored or improved in millions of communities throughout the world, solving in large measure some of the most difficult problems of food distribution and human nutrition.

The nutritive value of food produced on land rich in the constituents of plant nutrition undoubtedly will be greater than that from impoverished land, which has been stripped of its topsoil by erosion, with everything the topsoil contains: available elements of nutrition—both minor and major—all that man puts into the topsoil, and everything else. With so much eroded land around the earth, is there any wonder that malnutrition and famine are so widespread?

Development of land and water resources for agriculture—as by drainage or irrigation—will be governed by factual, technological elements of land use and land maintenance rather than by promotional, exploitative, or political standards.

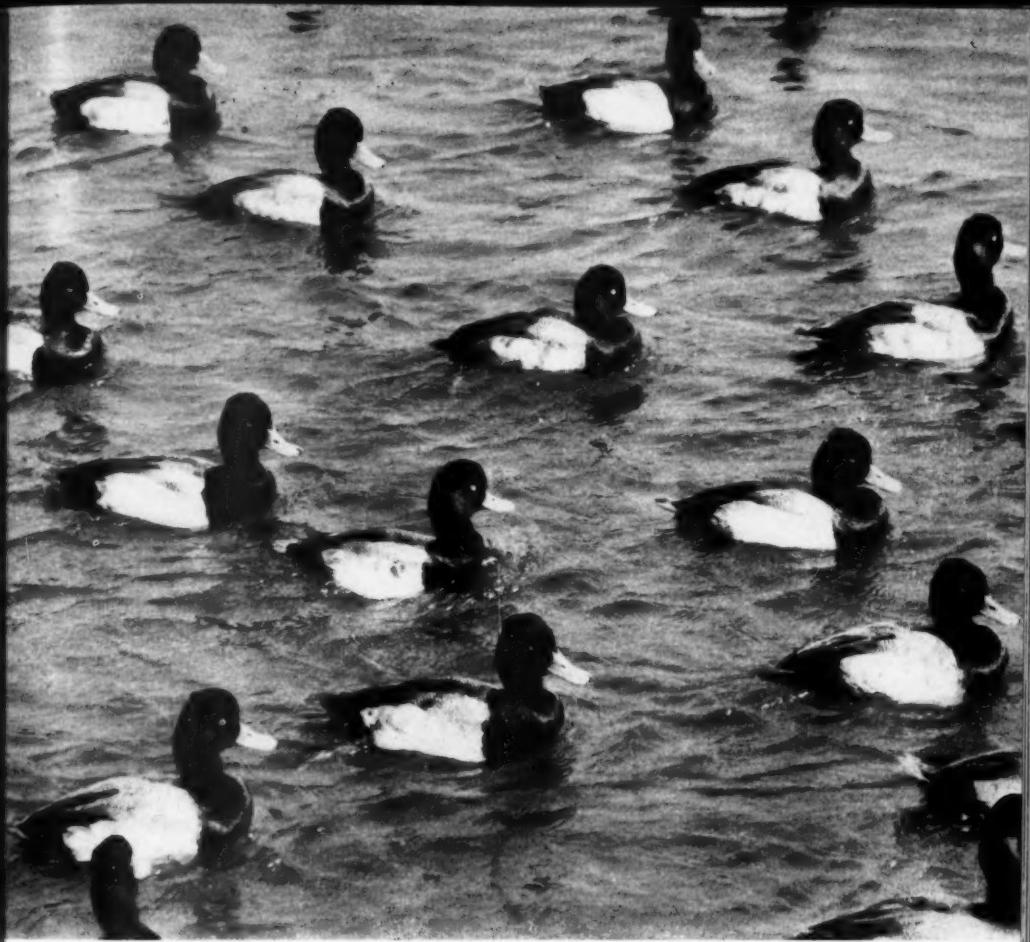
And people will learn that it is easier—easier on machine, horse, and man—to farm according to conservation standards than to follow haphazard methods not fitted to the land. Less fuel and time, for example, are required to operate a machine on the level—on the contour—and there is less wear on the machine.

The heavy costs of erosion—now running to approximately \$3,844,000,000 a year in the United States alone—will be sharply cut.

Farming will become an expert profession; the inexpert and inept will be forced off the land. It is not impossible that the prospective farmer of the future will be required to satisfy society that he is qualified by training and experience to take on the trusteeship of a piece of productive land.

Most important, man will have learned the true value of his most precious natural resource: the land. Tragically, throughout history, it has been the most neglected.

On this job of safeguarding the land, thousands of farmers, in addition to various local, state, and federal agencies, are vigorously pushing ahead. Each individual so engaged is a part of the biggest job, I think, in engineering and human affairs ever undertaken anywhere.



An ornithologist looks at

*Scaup photographed by
Allan D. Cruckshank*

WATERFOWL

By Ludlow Griscom

ONE of the outstanding events of the conservation year of 1946 was the sharp decline in the continental supply of waterfowl. Moreover, the proved decline came on the heels of widely publicized releases that the duck restoration program had been so gloriously successful that many hunting restrictions should be removed. To put it mildly, ignorance and prejudice of an amateurish kind

exist among both sportsmen and bird-lovers. The hunters are not the menace to the ducks some bird-lovers think. The bird-lovers are not the menace to sport the hunters think. Actually a decline in ducks is far more serious to sportsmen than to bird-lovers. It takes far more ducks to furnish fun for gunners than for opera glass wielders! In arguing over minute details of fact and opinion, funda-

mental biological principles have been forgotten or ignored. An effort to emphasize them would appear timely.

I take as my premise that sound conservation is an applied science based on biology, and must consequently accept and reckon with certain fundamental biological principles. You may call them laws of nature if you will, or think of them as the acts of God. The time element involved is infinitely longer than normal human patience.

1. Every duck has always had a limited breeding range and a definitely limited winter range. The total number of individuals can never be greater than the number that can find favorable breeding habitats, nor can it be greater than the carrying capacity of the winter range.

2. It follows that the total number of individuals in existence will be based on whichever of these two factors *is the lesser*.

3. The total number of individuals is also a balance which has been struck between many other favorable and unfavorable factors. In addition to habitat there are climate, pressure from enemies, food supply, disease, strain and loss from mi-

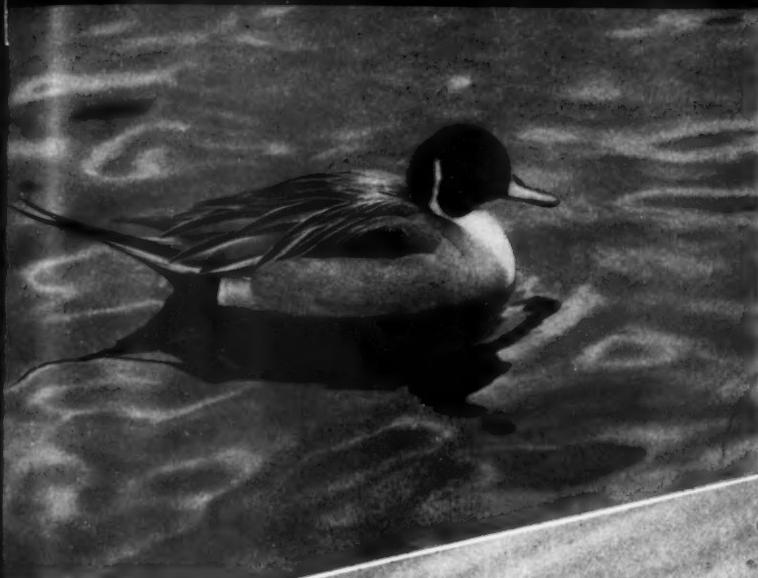
gration, reproductive fertility, an unbalanced sex ratio, to mention some only of the more obvious.

4. In a primeval wilderness, none of these factors ever was or ever will be static. Minor variations in temperature and rainfall cause immediate fluctuations in plant crops, the number of small fish and invertebrates. Major climatic variations result in droughts and "dust bowls," or severe freezes of marshes and ponds in the winter range. Peak populations inevitably decline, and are suspected of starting a new cycle of epidemic diseases.

5. It is inconceivable that *all* favorable and unfavorable factors remain absolutely static two years in succession. Nature is cyclic, climate is cyclic, all living things are subject to cyclic increases and decreases. Once ever so often, thanks to the arithmetical principles of the least common multiple, many favorable factors in combination result in a peak of abundance. Inevitably another major cyclic swing will produce years with a *maximum number and development* of unfavorable factors. The population "crashes" to a "low," which certainly causes a decline of 50 per cent, and pos-



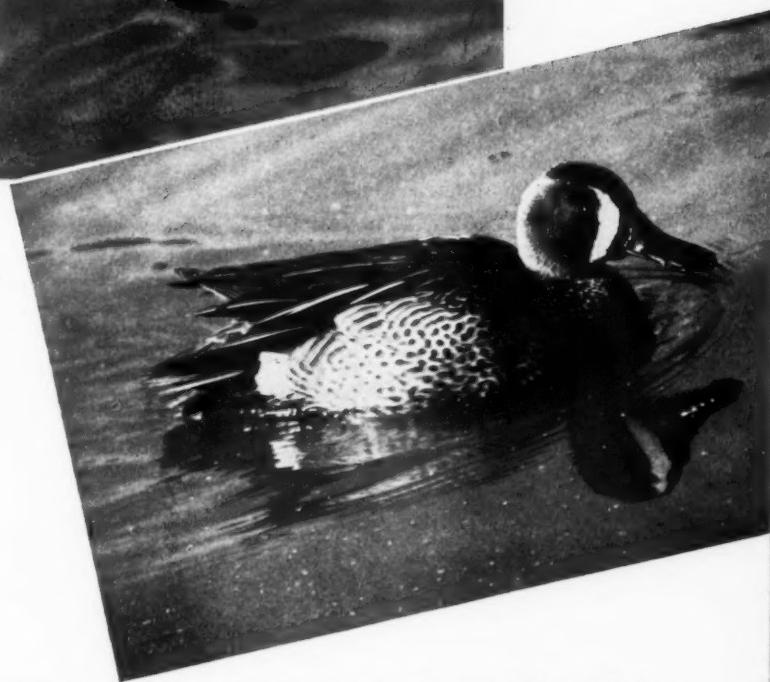
*Photographs
by Allan D.
Cruickshank*



**On the opposite page,
a family of Canada
geese.**

Above, a pintail.

**Right, blue-winged
teal.**



sibly up to 75 per cent of the total number of individuals in existence during the boom years. These population swings went on centuries before the first gun was fired in the New World, are taking place in our time, and will surely continue should the firing of a gun be made illegal forever.

6. Over most of these factors *man at present has no control whatever*. It is, therefore, silly for interested men to shake hands and congratulate themselves on their supposed prowess, after two or three "good" years have seen a gratify-

ing increase in the population. Their happy assumption that they deserve all the credit, and that this gain will be permanent, is doomed to disappointment.

7. It is equally unrealistic to set up a howl of grief and anger, when the inevitable decline takes place, and to blame the government or any human organization or agency. It is not necessarily due *solely* to hunting.

8. The historical period of research, study and conservation management is far too short to warrant placing any ceil-



ing on the maximum possible number of waterfowl the continent can support under present conditions. We simply do not know whether the greatest possible combination of favorable circumstances has occurred in our time or not. It would appear most improbable.

9. We positively do know, however, the maximum possible combination of unfavorable factors has *not* occurred. Every fifty thousand or so years there is an Ice Age. When the fifth will arrive we do not know, but when it does, not only the ducks but our human civilization will disappear from much of North America like chaff before a hurricane.

10. There is great need for realism in another direction. Nature appears both prodigal and wasteful. We must accept an annual mortality which reaches truly astronomical figures. If a population is remaining constant, one pair of birds starts the breeding season, they lay X number of eggs, a smaller number of fledged young start south with the adults, and *only one healthy pair* need survive to start next year's breeding season. The very great majority of all individuals in existence perish annually, in the natural order of events, in the primeval wilderness.

Let us then force ourselves to consider realistically what these normal annual losses actually are. To prove it requires simple arithmetic only, based on the figures supplied by the U. S. Fish and Wildlife Service. The accuracy of the figures does not affect the argument or the principle involved.

- a. In 1944 there were 125,300,000 ducks.
- b. Let us call it 60 million pairs in round numbers.
- c. Ducks lay 10-16 eggs.
- d. Which makes a potential of between 600 million and a billion birds.

Natural habitat growth of watershield with a few pads of white waterlily and stems of jointed spikerush. Typical of certain Georgia ponds and especially good for ring-necked ducks. Photograph by William P. Baldwin.

- e. In a static population, only 125 million return to the breeding area.
- f. Therefore, a potential of 475-875 million birds have been lost.
- g. The kill of 1944, 20 million birds, is mere chicken feed, as it is about four per cent of the lesser figure.
- h. It becomes vitally important, however, if too few eggs are laid, too few hatch, or too few downy chicks are raised to maturity.

I know of no more interesting illustration of the clash between sentiment and biology. I have every respect for the many Americans who feel a pang when a duck is killed by hunter or hawk. They are much more philosophic about the downy chicks which never grew up, completely calm over the eggs which did not hatch, and ice cold over the eggs which might have been laid but were not. They are also philosophic about all losses of grown birds from all other natural causes combined during fall, winter and spring. Unfortunately sportsmen are equally uninterested.

Nevertheless, birds are sure to become extinct, which fail signally in *any one of these three early stages* too many years in succession. As far as the biology of survival is concerned, it make no difference at which one of the six stages of the year's life history the death of the individual occurs.

Bird-lovers who accuse naturalists who advance this view of being cold blooded forget that human vital statistics are compiled in exactly the same way. If we wish to show that the population of New York City is increasing, all we have to do is to prove that the annual birth rate exceeds the death rate. It is immaterial at what ages the various deaths occurred. France has been alarmed for years at her declining birth rate. There was a slow, steady population increase in western Europe during the Dark and Middle Ages in spite of the mortality caused by constant strife, violence and wars, with epidemics of smallpox, cholera, and typhus thrown in, which caused sharp temporary decreases in the popula-

tion. The fundamental biology of ducks and humans has much in common!

It would appear to be of relatively small consequence under primeval conditions just which unfavorable factors caused the mortality in any one year, or in what proportion. In an undisturbed state of nature they automatically cancel out and strike a normal balance. If peak numbers of predators cause a decline, the decline causes the starvation of the predators, whose number in turn decreases to par. No one ever heard of parasites and epidemic diseases exterminating themselves by exterminating their hosts! The decline caused by a series of hard winters is certain to be made up by the survival of unusual numbers in the series of mild winters sure to follow sometime in the future.

It is, consequently, my earnest conviction that some people interested in conservation must take a longer view and learn these fundamental propositions in the natural history of animals. Bird-lovers as well as sportsmen should benefit by education, and each group must give up some cherished illusions, and adopt a more realistic attitude.

1. No amount of success in conservation will ever make possible an unlimited hunting season, and no closed season will ever produce an unlimited supply of ducks. The biologists of the U. S. Fish and Wildlife Service are well aware of these propositions, but usually fail to mention them except when fate forces them to apologize for a decline in ducks. Moreover, they have no appropriations for a real educational program.

2. Under certain conditions, the size of the kill would be of no consequence whatever, and a closed season could not prevent a decline from natural causes. For instance:—Let us assume that the carrying capacity of the winter range is only two-thirds of the ducks leaving the breeding grounds after a signally successful season. Let us further assume that hunting regulations, which would have produced a kill of 20 million birds, are

replaced by a closed season. Obviously 20 million birds would be "saved." But if the winter range will only carry two-thirds of the summer crop, how in the name of common sense can it carry two-thirds plus 20 million!

3. It is an equally serious illusion of certain sportsmen that more breeding habitats will create a large surplus which can be killed, because the winter range will not support them. In the first place, a *permanently closed season throughout the winter range* would be required. And who, pray, can calculate the percentage of the surplus, or predict in advance the losses from natural causes of the winter and ensuing spring migration?

Now let us try to apply some of these propositions more specifically to our North American ducks. We are anxious to conserve them, by which we mean not only that we wish to maintain their present numbers, but if possible restore some percentage of their former numbers. The chances for success are best discovered by an appraisal of assets and liabilities.

There are very real assets furnished by the birds themselves. They are hardy, tough, wary in danger, increasingly adaptable under protection. More and more they are accepting civilization, nesting in the immediate vicinity of man and wintering in places and under conditions which were inconceivable in my boyhood. Their reproductive fertility is one of the highest of any bird group on earth.

The liabilities may be divided into two categories, the ones over which man has virtually no control, and those few remaining, where he has.

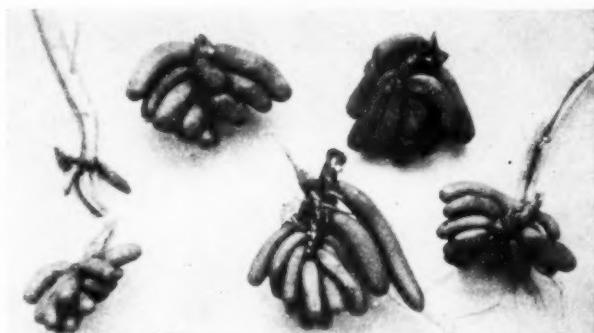
First and foremost of these latter is the question of habitat. Our waterfowl have very definite and restricted habitat requirements, and let us say that 75 per cent of the continent does not interest them in the least. They must have marshes and ponds in which to breed. Their decrease in the last 300 years, to their present numbers, is primarily due to the loss of a large percentage of their former breeding territory and the de-

struction of portions of their former wintering grounds. The national slogan of all unselfish sportsmen and bird watchers should be "No marsh, no ducks, no sport."

The second great liability, unrestricted market gunning throughout the year, which seriously cut the surviving population *below* the carrying capacity of the remaining favorable territory, has been illegal for over a quarter of a century.

swarm of ducks to move south in 1944 in a quarter of a century. There was some astonishment that this great surplus could not be found by the end of the following winter, and every one admits that it had evaporated in 1946. Again, the breeding season of 1945 was not a serious failure, and every one with adequate field experience is impressed by the amount of possible breeding territory in the northern states and Canada which

We need more study of the plant and animal food available on the winter range. Roots of the banana waterlily, shown at the right, are a highly esteemed duck food. (Photograph courtesy of U. S. Fish and Wildlife Service.)



Its virtual elimination made possible an immediate and permanent increase in the total population.

One of the outstanding generalizations about our waterfowl, beautifully brought out by Dr. Frederick C. Lincoln of the U. S. Fish and Wildlife Service, was that the winter range of most species was enormously compressed in total acreage as compared to the breeding range.

It follows that the carrying capacity of the *remaining winter range* is possibly the critical factor, which places a definite ceiling on our total waterfowl population. My conviction that this is so has been steadily growing in recent years. The evidence is as follows:

The cycle of drought years in the 1930s, which produced the "dust bowl" era, affected the breeding grounds primarily. Interest and most competent effort turned to a restoration of breeding areas. Not only were these efforts successful, but the drought broke, and a series of good years produced the greatest

is unoccupied, or not fully occupied. Finally everyone knows that civilization has developed by leaps and bounds in the last quarter of a century in what were preeminently rural southern states.

One may well ask the rhetorical question—of what use is it to raise a large crop of young on the breeding grounds if the winter range will support two-thirds of them only?

We are now in a position to comment sensibly on the hope expressed earlier that some percentage of the former numbers of waterfowl could be restored.

In biological terms there is only one way in which it can be done. To recapture a former range, any reduced species must be able to develop a surplus population in its surviving range. This surplus population will inevitably be produced on the breeding grounds as the result of a succession of good years. Unless this surplus can survive on the winter range, there will be no birds to extend the breeding range or occupy it more fully.



Two different sets of favorable environment are consequently prerequisite. While mere protection from hunting is not alone sufficient, the production of this surplus population might easily require a closed season in poor years.

It follows that the federal government's wildlife refuge program is of fundamental importance. The so-called advance of civilization has always in-

is bitterly opposed by local sportsmen. They reason that if 10,000 acres of duck marsh become a refuge out of a total of 20,000, their shooting has been cut 50 per cent forever. But they forget that some years later, population increases and the march of civilization may have drained all 20,000 acres; then there will be no ducks in that section of the country, never again, absolutely never. More-

Comparison of the maps on the opposite page—above, breeding grounds of North American waterfowl; below, wintering grounds—will illustrate the inadequacy of the winter range. The carrying capacity of the remaining winter range is possibly the critical factor in our waterfowl population.

Right, tubers of the delta duckpotato (*Sagittaria platyphylla*) which is important as a food for ducks wintering along the Gulf of Mexico. (Photograph courtesy of U. S. Fish and Wildlife Service.)

volved the draining of marshes and ponds, the pollution of rivers, estuaries and bays. In the long range view the total number of waterfowl will be limited to the acreage of favorable habitat which can be preserved, intact, and unspoiled, and the number of birds it can support. A permanently closed season could not possibly increase this number.

There cannot be less than three million Americans genuinely interested in our waterfowl. They are really concerned for various reasons whenever there is a decline. Most of them blow off steam in quarreling about the proper hunting regulations of the particular year. Some bird-lovers are convinced that every decline is due to too long a hunting season the year before! Almost every effort of the government to acquire a new refuge

over they refuse to learn the easily proved fact that federal management has always increased the ducks 5-25 fold in a reasonable number of years and enormously improved the local shooting.

To continue the method of approach originally adopted, the toll of ducks killed in the hunting season is one more unfavorable factor for them, and constitutes the third liability over which man has control. This annual kill is not one of the many natural factors which produce the prodigious annual mortality, which is the lot of all living animals, the tenth of my original propositions. Sportsmen must face the fact that it is a relatively new and additional strain in the struggle for survival. Those who wish sport to continue must consequently take whatever steps are necessary to see that



this strain is compensated for. In return for the bad, some good must be done the ducks.

While I have tried to show that the preservation of favorable environments and habitats is of fundamental importance in conserving our waterfowl, it does not follow that there is no point in properly restricted hunting regulations. I hasten to reaffirm my conviction that they too are absolutely essential. I have no intention of entering into a discussion of the technical details of any one year. No private individual or organization has the necessary knowledge of detailed facts. Even the officials of the federal government are forced to exercise their best judgment, based on estimates. But proper restrictions will be better appreciated if the people interested see more clearly what restrictions cannot accomplish and why.

Again, there is a human element. People do not like to be restricted, and will not obey restrictions which they do not understand. There are practical problems here with which I am not directly concerned, but of which I am sympathetically aware. But I must urge ever more scientifically sound and ideal hunting regulations, as research increases our knowledge. An educational program to sell these ideas to the public is badly needed. This seems to me a more constructive policy than the mere criticism of each year's regulations.

I consequently venture to close these remarks by suggesting certain general propositions. It is my hope that they may correctly apply to hunting the fundamental points of natural history just discussed. In no case is criticism of current regulations intended or implied.

1. The degree to which hunting is liberal or restricted should depend (a) upon the carrying capacity of the environment because that determines the supply and (b) whether the amount of suitable territory is shrinking or expanding. Neither of these factors remains static for very long.

2. Those species of waterfowl whose breeding or winter ranges have been the most seriously destroyed by civilization should be given special protection to the degree required.

3. Those species which show marked inability to adjust properly to civilization should receive some extra protection. Outstanding examples are the redhead and ruddy duck.

4. Hunting should be closed in those sections of the winter range where a failure in food supply occurs, where disease breaks out, or severe drought conditions exist.

5. Further research and improvement in techniques is possible in estimating the plant and animal food crop on the winter range; in other words, its carrying capacity. This would be more important than a mid-winter census.

6. The results of the breeding season and the carrying capacity of the winter range furnish the ideal criteria for the open season, whichever is the lower.

7. The annual kill should never exceed a minor percentage of the total annual losses.

8. The annual kill should never reduce the total population below the carrying capacity of the winter range.

9. There is no ground for abandoning hope that our waterfowl can be restored or increased as well as conserved. An extension of the wildlife refuge program particularly in the winter range, is a prerequisite for a permanent gain.

10. More liberal hunting must not kill off the surplus population which must be created.

11. An increase in hunters must be compensated for by a corresponding decrease in the permissible take.

12. If this surplus population has additional preserved or reclaimed territory in which to breed and winter, a permanent gain will have been made.

Sportsmen and bird-lovers will both gain in the long run, and our duty to conserve our natural heritage of wildlife will have been more than well done.

LEARN from the OWL

*about the small mammals
present in your community*

By Ernest C. Driver

WHAT does a bird eat? Some of our bird books list a number of food items and then tell us that the data were derived from examinations of the contents of several hundred bird crops and gizzards. That is certainly getting information the hard way, at least as far as the birds themselves are concerned. Most of us prefer the bird in the bush to the bird in the hand, especially when the latter must be eviscerated. Fortunately, a few birds have internal workings that enable us to read their menus without harm to the birds.

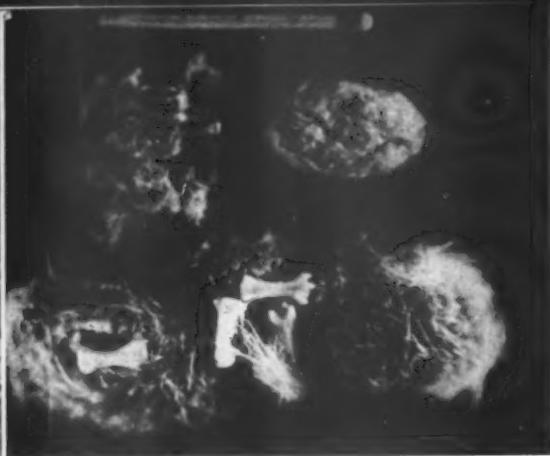
Owls, hawks, crows and a few others gulp their food in large chunks, pass the digestible portions on to the intestine, and cough up the indigestible parts. In the case of the owls, these regurgitated pellets consist almost entirely of hair or feathers and bone fragments, usually large enough to be fairly easily identified. These pellets are frequently numerous under large evergreens where the owl hides during its resting hours, and if we find a regularly used roost we may actually find pellets by the hundreds.

The owls are better hunters and more steadily on the job than we can hope to be. From their leavings we can get a good idea of the variety of small local mammals. One use we may make is to check up on the presence of rare animals in our neighborhood.

For example, the immigrant black rat (*Rattus rattus*), once the carrier of the bubonic plague or Black Death, has been driven out of most of its former territory by the almost equally undesirable gray, Norway, or barn rat (*Rattus norvegicus*).

Photograph by
Bert Popowshi





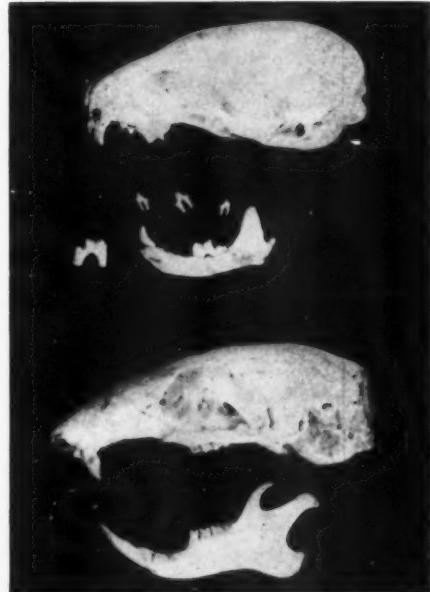
Small colonies still remain, though. There may be some, unsuspected even by the local scientists, in your community. If so, the large owls are likely to know about it and will help you find out.

Another interesting study can be made on your choice picnic grounds or hiking territory. Check on the owl pellets for several years, keeping a record of the proportions of the meadow mouse (*Microtus*), for example, in relation to other forms. We know that some of the common rodents have cycles of abundance like those of the Arctic hare and the lemming, but we do not know all of the details. Perhaps your owl pellet records will show such fluctuations. If they do, you can get much mental exercise by trying to correlate them with changes in the local habitat, severity of winter, amount of snow, amount of spring rain, sun spots, or any other factors which may be directly or indirectly related. Even if you have no scientific aspirations, it is still worth while to learn to see and identify these remains, even if only for the satisfaction we all feel in solving a puzzle.

The pellets themselves are usually oval and from one to four inches long. Their size is some indication of the kind of owl which left them. They may be mistaken for fox droppings, but the latter, unless very fresh, are definitely dusty and often contain considerable obvious vege-

table matter, whereas the owl pellet is almost always nothing but bones and fur or feathers. The bones are usually well wrapped, and those of us who have kept owls in captivity have found that if bony meat without fur or feathers is fed, the owl either hunts up some substitute wrapping, such as cloth or paper, or else becomes sick.

Having gathered some pellets, let us study them. Note first that the wrapping usually comes from the same animal as the bones it contains. If it is feathers, the



Top, left, two sets of owl pellets—smaller, screech owl; larger (pellet of skunk fur and bones) from great horned owl.

Above, the top skull, that of a weasel, shows carnivore characters and teeth. The second, a typical rodent skull, is that of a chipmunk.

On opposite page, bat skulls and a mole skull and bones are beside the match for scale. Next, a muskrat skull shows cheek teeth bearing enamel loops or triangles. At right, a rat skull, showing teeth with cusps or rounded tubercles.

Photographs by the author.

sharp splinters of hollow bird bones will be found. We have found the identification of bird fragments quite difficult, and advise that you pay most attention to the fur-wrapped pellets of mammal remains. If long guard hairs are present, the coloration, and frequently the banded arrangement of color on these, may offer a good clue to the identity of the late owner. Agouti or "pepper-and-salt" colored mammals such as the rabbits and some of the mice show marked color bandings on these hairs, very different from the uniformly colored hairs of skunk or muskrat.

The texture of the hair should also be noted. If a good microscope is available, clean and clear the hairs in xylol and mount on slides for study. Carbolxylol and balsam mounts may be built up into a good permanent check collection. Close observation and very careful adjustments of focus and light are necessary. For descriptions and pictures of mammal hairs, look up the article on *Structural Characteristics of the Hair of Mammals*, by Dr. Leon Hausman, in Volume 54 of the *American Naturalist*.



Photograph by
Edgerton

The bones are easier to work with, especially the skull, since the major part is often in one piece. The back of the skull is almost always crushed, as the owl kills its prey by a bite in that region. Take care that the teeth do not fall out and get lost when the wrapping of fur is removed. Lay out the jaws, skulls, loose teeth and some of the hair for study. Note also the leg bones. Rodents are the chief owl food, and the tibia and fibula (the bones of the lower part of the leg) are joined at either end, often appearing in V or Y-shaped fragments.



Now for the skulls and jaws. In the rodents there are only two upper and two lower front or incisor teeth, and these are separated from the grinding or cheek teeth by a long toothless space. Very similar, and often classed with the rodents, are the rabbits. In addition to their being larger than most native rodents, the very spongy bone in the nasal region and the two tiny teeth directly behind the upper front two will serve to distinguish their skulls. In a few rodents the upper front incisors are grooved and so there may appear to be four, but the gap between them and the cheek teeth still reveals the owner's true group or order.

The two rodent families most often falling prey to the owl are those of the squirrels and the mice. To tell the skulls apart, look at the top rim of the eye socket or orbit. If a small more-or-less triangular projection juts out from this top rim, directly above the eye socket, the former owner was a member of the squirrel family. This includes, in addition to the gray, red, flying, and fox squirrels, the woodchuck, prairie dogs, chipmunks and ground squirrels. Several of these have skulls very much alike, so the investigator must learn to notice small

Photograph
by Allan D.
Cruickshank



differences. On the side of the nose and leading, usually, into the front of the eye socket, is a small opening, called the infra-orbital opening. In the gray, red and fox squirrels this opening is very narrow and slitlike. In the chipmunks it is oval, in the ground squirrels triangular.

The mouse family (or group of families) is very large, but two kinds, the deer or white-footed mouse (*Peromyscus*), and the meadow mouse (*Microtus*), or vole (not mole!) are by far the most commonly represented in owl pellets. When an owl finds a good hunting ground he works it intensively, so don't be surprised to find that one collection of pellets may consist almost entirely of the remains of one kind of mouse.

Cheek teeth offer the best distinguishing character between the skulls of the deer and meadow mouse and can be checked fairly easily even on loose teeth. A hand lens is a help in examining tooth detail. The teeth of the meadow mouse have angular ridges on their sides and the enamel forms a series of irregular triangles on their crowns. The fur of these mice is coarse and a fairly even brown. Pellets found near marshy areas or coarse grass lands are very likely to contain these.

The deer mouse, which usually prefers woodlands, has cheek teeth with rounded side flutings and with two rows of cusps or tubercles on their crowns, somewhat resembling miniature human teeth. Both grayish and white hairs will usually be present in the pellet.



Remains of mammals other than rodents are often found in the larger pellets. Long skulls of great thinness and with the teeth (or their sockets) forming a continuous series around the jaw are probably those of insectivores. If the teeth are white, the owl has surprised a mole that ventured too far from its burrow under the cover of night. The leg bones will be short and remarkably stout. If the teeth are chestnut red and the leg bones no more massive than those of a mouse, the victim was a shrew.

Few of us know much about shrews, because their quickness and habit of burrowing under fallen leaves or using mouse runways enables them to elude us. They are really quite numerous, but are rarely found in owl pellets because, although owls kill many of them, the musk glands of the shrew make them distasteful.

Tiny, short skulls, with an evident gap in the front part of the upper jaw and with a general bulldog look are those of bats. Carnivore skulls, being larger, are usually found only in fragmentary form in owl pellets. The smallest likely to be found are those of weasels. The brain case is long and thin and usually broken into fragments. The tiny jaws, only about half an inch long, carry teeth like those of a dog on a very small scale. Only in the pellets of the great horned and barred owls are you likely to find parts of mink and skunk skulls, and the hairs present in the pellets will help greatly in separating the two.

On your hikes through the woods make a point of looking for owl pellets under isolated trees, the occasional tree that overtops the rest, and under any small group of evergreens.

Whether you study owl pellets for scientific purposes or just for fun, you are bound to learn a lot about owls and their habits; you will learn about the small mammals of your community, and their relationships, and to your outings you will have added a new interest.

The NATURE of THINGS

Comments on the new Nature Literature —

By Richard H. Pough

MUSIC IN NATURE

By Loyal H. Miller, University of California Press, Berkeley, Calif., 1942. On four vinylite discs, seven sides recorded. 12 inches. \$5.00.

This talk on animal sounds in nature has recently become generally available through a new pressing on vinylite. It contains excellent imitations of many western animals including some thirty-three birds. These are interspersed, often in contrasting pairs, throughout Dr. Miller's most interesting discussion of the basic elements of any natural sound such as its timing, tone, pitch and timbre. It should be very helpful to beginners who are trying to learn to analyze the differences between various songs. It will also familiarize them with the expressions used to describe songs in print.

LOUIS AGASSIZ AS A TEACHER

By Lane Cooper, Comstock Publishing Co., Ithaca, N. Y., 1945. 5½ x 8¾, 90 pages. \$1.50.

This biographical account is concerned largely with Agassiz's teaching technique as revealed by the experiences of a number of famous scientists who were his pupils. It includes, however, a brief chronological biography of his life and work.

THE OTTER BOOK

By Phyllis Kelway Collins, William Collins Sons & Co., Ltd., London, England, 1944. 5¾ x 8¼ inches, 144 pages, illustrated. \$1.50.

This book is about the author's experiences with a pet otter. They make a very interesting story which is well illustrated with excellent photographs. The otter is revealed as a remarkably intelligent animal and a wonderful pet that can be given as much freedom as a dog.

THE MAMMALS OF MICHIGAN

By William H. Burt, The University of Michigan Press, Ann Arbor, Mich., 1946. 7 x 10¼ inches, 288 pages, 13 color plates and numerous drawings by Richard P. Grossenheider. \$3.50.

This well-organized volume is an outstanding addition to the expanding collection of state mammal books. The text covers 64 species and is preceded by 78 pages of introductory material including keys. Mr. Grossenheider's excellent paintings and sketches make this a very handsome book.

FLORIDA CRUISE

Edited by Norman Alan Hill, George W. King
Printing Company, Baltimore, Md., 1945. \$5.00.

This is a collection of over 40 contributions by almost as many authors. They deal with the legends, history, scenery, wildlife and resorts of Florida. A considerable part of the book, however, is devoted to the day by day details of cruises in Florida water by the various authors. Alexander Sprunt is the author of a short contribution on the roseate spoonbill.

PLANTS OF HAWAII NATIONAL PARK ILLUSTRATIVE OF PLANTS AND CUSTOMS OF THE SOUTH SEAS

By Otto Degener, N. Y. Botanical Garden, Bronx, N. Y., 1945, 6 x 9 inches, 329 pages, illustrated. \$2.50.

This is not a technical flora of the South Seas but a well-illustrated collection of very interesting accounts of the common plants of the region and the uses which the native people made of them. Dr. Degener has gone so deeply into the old customs and history that the book is excellent reading just as a regional study.

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BIRDS

BIRDS IN KANSAS

By Arthur L. Goodrich, Jr., Kansas State Board of Agriculture, Topeka, Kansas, 1946. 5 3/4 x 8 3/4, 340 pages, 6 colored plates, 169 black and white illustrations. Free.

This is a handy unpretentious guide, illustrated with many black and white line drawings from a number of sources. Unfortunately, they are often none too helpful and the color plates only show 9 species in all. A 68-page introduction covers the general biology and ecology of birds and their relation to man. The species are discussed in systematic order but in two sections—one on the common birds, followed by an all inclusive section. The significant field characters, range, voice, nest and habits of each one are all very briefly treated in a single paragraph for each species.

BIRDS OF THE LOWER FLORIDA KEYS

By Earle R. Greene, Florida Audubon Society, Winter Park, Fla., 1946. 6 x 9 inches, 67 pages, illustrated, paper covers. 1946.

This volume published as No. 3, Volume 8 of the quarterly journal of the Florida Academy of Sciences is an annotated list of the birds observed by the author during the 3 1/2 years he was stationed in the area as warden of the Key West and Great White Heron Refuges of the United States Fish and Wildlife Service.

A CHECK LIST OF WEST VIRGINIA BIRDS

By Maurice G. Brooks, Agricultural Experiment Station, Morgantown, W. Va., 1944. 6 x 9 inches, 56 pages, paper covers. Free.

West Virginia is a state of more than ordinary ornithological interest. Its combination of mountain and lowland with the wide variety of habitats they afford, gives it a very rich bird fauna. This annotated check-list incorporates the many interesting distributional discoveries of recent years.

THE BIRDS OF KUTCH

By Salim Ali, Oxford University Press, New York, N. Y., 1946. 7 1/2 x 10 inches, 175 pages, 32 photographs, 20 colored plates. \$10.00.

Kutch is an islandlike rather arid area on the northwest coast of India, surrounded by a vast area of flat, barren wasteland that is annually inundated by salt and brackish water during the monsoon period. It is the only known place in India where the common flamingo breeds, the colony in 1945 numbering some half million birds. The species are treated in standard ornithological order with a paragraph on size, field characters, status and distribution, nesting and measurements for each.

FOR YOUNG READERS

SOUTH AMERICAN ZOO

By Victor W. Von Hagen, Julian Messner, Inc., New York, N. Y., 1946. 6½ x 9½ inches, 182 pages, illustrated. \$2.50.

Lee Jaques' beautiful scratchboard illustrations make this a handsome volume. Popularly written it treats in brief chapters of two or three pages the various outstanding mammals, birds and reptiles of South America and its outlying islands. The nature of the habitat for animals provided by each of the four great continental divisions—the Pampas, the Jungle, the Andes and the Islands—also receives a chapter.

THE TALE OF THE CROW

By Henry B. Kane, Alfred A. Knopf, New York, N. Y., 1943. 7¼ x 9¼ inches, 48 pages, photographs and drawings. \$1.75.

This charming book is the fourth in Mr. Kane's series of "Wild World Tales." They are a combination of splendid photographs beautifully reproduced, delightful drawings with a subtle touch of humor and a simple narrative text. The earlier books dealt with a white-footed mouse, a bullfrog and a promethea moth. The whole series deserves to be better known, as each is a beautiful piece of book-making and an ideal gift for a child.

THE WAY BIRDS LIVE

By Edward A. Armstrong, Transatlantic Arts, Inc., Forest Hills, N. Y., 1943. 5½ x 8¾ inches, 96 pages, illustrated. \$2.25.

This is a very readable and enjoyable book on a phase of bird life that has been badly neglected in this country. Everyone interested in the field study of birds should have this book, adults as well as older children, for whom the book was especially designed. It is simply written and well illustrated with photographs and drawings. The subject matter deals with the routine of a bird's daily life—how it lays claim to a nesting territory, courts, mates, rears and teaches its young.

WARM EARTH

By Dorothy Waugh, Oxford University Press, New York, N. Y., 1943. 7½ x 6¼ inches, 43 pages, illustrated. \$1.00.

This is a remarkably fine book for young children. Through a series of beautiful full page drawings and a simple yet scientifically accurate text, Miss Waugh tells the story of what soil is, its inhabitants and its role in feeding and supporting plants. Many adults will learn as much as children from it. It demonstrates better than any book I have seen what a wonderful teaching job can be done by scientific drawing.

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ANIMALS BY SETON, 295 pages, 64 species, \$3; Birds by Blanchan, 257 pages, 124 species, \$3; Wild Flowers, Blanchan, 270 pages, 170 kinds, \$2; Butterflies by Weed, 286 pages, 109 species, \$2; Garden Flowers, McCurdy, 111 pages, 400 kinds, \$2; Trees by Rogers, 291 pages, 226 species, \$3; Book measures 8¾ x 5½ inches, 48 color plates each. Six volume set \$10, remittance with order. Full refund if returned in 5 days. *Literary Mart*, 8 East 33rd Street, New York.

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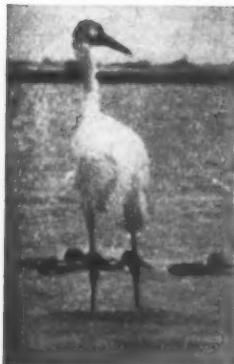
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THE PRESIDENT'S

Report to You



*Whooping
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WHEN the wildlife protective patrol responsibilities in the area of the Everglades National Wildlife Refuge were turned over to the U. S. Fish and Wildlife Service, your Society retained, at the request of the Service, responsibility for the conduct of wildlife tours to show the public the animals and plants, the presence of which constitutes the primary reason for the establishment of the refuge and the justification for eventual National Park status.

Through our efforts widespread popular appreciation of the value of the refuge and support for its continued maintenance may be aroused. As a consequence of many years of protection by the Society's wardens, wildlife populations, particularly those of the birds congregated in the rookeries, have been substantially built up and we are especially interested in showing the results to Audubon wildlife tourists.

It is fortunate that the Fish and Wildlife Service has taken over the patrols in this sizable region, so that the Audubon wardens could be shifted farther northward along Florida's southwest coast, and continue their efforts in the Tampa Bay and Okeechobee sections.

CHARLES M. BROOKFIELD, TOUR LEADER

The great majority of the wildlife tourists, whom it has been our privilege

to take afield by station wagon or boat in Florida, have been residents of the northern states on winter vacation in Florida. This fall, however, we were able to initiate tours to appeal primarily to year-round residents of Greater Miami. Charles M. Brookfield, of Coconut Grove, was appointed in September as the Society's Tropical Florida Representative. A man with a life-long interest in the out-of-doors and with twenty-two years of residence in South Florida, Brookfield is well equipped not only to conduct our tours with success, but to represent the Society in the development of its various activities in Miami, and environs. Beginning in mid-October,

station wagon tours have been conducted out the Tamiami Trail and around the Loop Road. Through December 11th, 125 persons had participated in twenty such tours.

Among the animals seen on these tours that are of particular interest are otters, anhingas, alligators, bobcats, egrets, wood and white ibises, barred owls, fox squirrels, wild turkeys, red-shouldered and short-tailed hawks and eagles. A panther has been seen once. Much of the vegetation is entirely new to visitors. Red, white and black mangrove are widely dispersed, as are buttonwood, wild tamarind, wild lime, Jamaica dogwood, wild cinnamon and manchineel. There are Madeira and native royal palms.

With the advent of mid-January, two-day tours will be taken twice each week. On the first day the route follows the Cape Sable Road to Coot Bay Dock where tourists shift to the Society's boat *Egret* for a cruise in Whitewater Bay and up the East River to the site of one of the great egret, heron and ibis rookeries. With an eye to avoiding any possible disturbance of the birds in that rookery, a wooden tower has been erected a short distance away, from the top of which tourists are able to view to advantage the whole panorama of the rookery.

On evening of the first day tourists reach Tavernier, on Key Largo, where there are comfortable overnight accommodations. On the second morning, your Society's boat *Spoonbill* takes them on a cruise of Florida Bay where they may reasonably expect to see man-o'-war birds, reddish egrets, great white herons and roseate spoonbills. If the demand be sufficient, and there is every indication that it will be, these tours will be continued until mid-April.

HUNTING IN FLORIDA

At no time in ten years has there been so much indiscriminate shooting of birds and other animals on the Tamiami Trail

or, more particularly, on the Loop Road; this, in spite of the constant presence of at least one state game warden and the traverse of this route up to three times a week by our tourists. On December 1st, there were thirteen hunting camps established along the Loop Road, each equipped with a glades buggy. On December 6th, wildlife had become so scarce as to cause Brookfield to shift the tours to the Ingraham Highway to Cape Sable. There is a law in Florida which makes hunting illegal in this area, but it has not as yet been enforced. There would seem to be rather an imperative need of its enforcement, or the devising of some other means of bringing this section under protection. The hunting pressure is too great and of a character too indiscriminate.

BOB ALLEN LOOKS FOR WHOOPING CRANES

Dr. O. S. Pettingill received such an attractive offer from Carleton College that he could not resist it and asked if he might be relieved of his responsibility to complete the whooping crane research project jointly sponsored by your Society and the Fish and Wildlife Service.

As luck would have it, Robert P. Allen, recently back from war service, and famous for his field researches on the life history and needs of the roseate spoonbill, was available. Bob took over as of November 1st and has been diligently searching all likely wintering grounds of these cranes in Louisiana and Texas. He has received the fullest, most interested cooperation on the part of the entire staff of the federal Aransas Wildlife Refuge at Austwell, Texas, the chosen winter haven of these cranes; also of officials of the Texas Fish, Game and Oyster Commission and of the Louisiana Department of Wildlife and Fisheries.

Records kept at the Aransas Refuge for the past nine years give an average of 19.2 whooping cranes present. Allen's figure, as of November 20th, was 17, including 3 young of the year. Each of these young was attached to a pair of

adults and there were 4 other pairs of adults without young. About a year ago, seven ecological stations were established, by the research staff of the refuge, with the cooperation of officials of the Texas Commission resident at Rockport. Allen has taken over responsibility for continued routine observations at these stations on the wintering grounds of the cranes, but with the continued full co-operation of those who initiated the project. He writes that he has constructed a blind resembling a cow, hoping thus to approach the cranes more closely and observe their feeding habits. We shall hope that the cranes will not have cause to fear Greeks bearing gifts!

As an experiment, the Fish and Wildlife Service has fenced off a section of the marsh most used by the cranes, so that it will, for the first time, be free from grazing cattle. Since various field workers have suggested that grazing may have limited the volume of desired food available to the birds, there will now be opportunity to test the effect of the grazing.

LOUISIANA WHOOPERS

Up to 1940, a number of cranes wintered regularly in the marshes of Louisiana and one or two pairs may have nested there. It is not beyond belief that some of the birds wintering in Texas may possibly nest in that state. In 1940 there was a flood of fresh water in western coastal Louisiana, and it appears that the cranes left the deep marsh and visited the rice fields, where a number of them were shot for food by farmers. Since that time, the only records of observation of cranes in Louisiana have been two sight records from the air by flyway biologists of the Fish and Wildlife Service. It is exciting news, therefore, that on December 16th, a telegram was received from Allen reading: "Found what we were looking for. Two in number. Letter follows." You will have to wait until the next issue, however, for the next installment of this whooping crane serial.

IVORY-BILLED WOODPECKER

The ivory-billed woodpecker is not yet extinct and your Society is making renewed effort to find means of successfully setting up a refuge within the boundaries of the tract in northeastern Louisiana where they are known to occur. Most of this tract has been cut over in recent years, but uncut timber still remains in small, scattered stands.

There is no evidence that these woodpeckers will adapt themselves to the use of recently cut-over areas, but it now seems clear that they are not dependent on the existence of primeval woods, and will continue to roost and feed in and on trees of much smaller diameter. While there is justifiable doubt that any species of animal reduced to such small members can survive, even though carefully protected, it is important that every effort to save the ivory-bill be made.

Even if the ivory-bill were to vanish, the area where it now lives would make a most desirable wildlife refuge, in which turkeys, deer, bear, squirrels, wolves and an abundance of other mammals and birds would continue to find ample food and cover, and in which the forest might be expected to re-attain seemingly primeval proportions in some eighty to a hundred years. The goal cannot be attained without generous financing.

RESEARCH ON THE RAINY

For 22 years some 26,000 acres of Louisiana marshlands have been under the administration of your Society as the Rainey Wildlife Refuge. Phrasology in the deed of gift makes the provision of sanctuary to migratory waterfowl the primary function. In order to contrive this objective many questions of land management must be considered. If we are to provide maximum quantities of food for such birds, we need to know the answer to such questions as whether or not the annual burning of the marsh—the prevailing custom throughout coastal Louisiana—is of benefit or hindrance; whether grazing by cattle is helpful or



Photograph by Pan-American Photo Shop

Charles M. Brookfield with a happy group of wildlife enthusiasts in South Florida

damaging; whether salinity and depth of water on the marsh are important controlling factors; whether artificial fertilization will produce ample waterfowl foods on submerged lake bottoms not now productive; whether and by what advantageous means the encroachment

of water hyacinths and alligator grass on duck ponds can be arrested; whether erosion can be controlled and eliminated at feasible cost.

At present no trapping, hunting or grazing is permitted, but annual burning is indulged in at a season when the seeds

of the grasses have dropped and there is sufficient water on the marsh to enable all animals to avoid the fire. Our property is contiguous with that of neighbors who regularly burn, so that it would be difficult to make a no-burning policy work; moreover, we know that if we did not burn at least a portion of our marsh annually, all of the blue and snow geese that now congregate on our land would desert our refuge in order to feed on the newly burned lands of neighbors. During December and January, Richard H. Pough, of our staff, was at the Rainey Sanctuary to make certain studies and establish a system for continuous records; all this with an eye to reconsideration of management policies, with consequent reaffirmation of those now prevailing, or the adoption of new ones.

DOROTHY TREAT HONORED

A signal honor has come to a member of our staff. The National Wohelo Order, the highest honor offered by Camp Fire Girls, Inc., was recently awarded to Miss Dorothy Treat because of "her long and very helpful association with Camp Fire Girls;" because "as a member of the staff of the Cleveland Museum of Natural History she assisted the Cleveland Council of Camp Fire Girls with its nature program;" because "she has taught at a number of our national training courses, has written articles for our publications and has served as consultant on the revision of our program." Miss Martha F. Allen, National Director, adds "we are particularly appreciative of the contributions she is making, as a member of your staff, to the education of young people throughout the United States. Through this honor to Miss Treat, our National Council wishes to pay tribute to the National Audubon Society for its far-reaching program of conservation and nature education."

IN THE WATERS OF LAGUNA MADRE

Between the mainland and the barrier islands of the south Texas coast lies a

very shallow strip of water averaging several miles in width and known as the Laguna Madre. It is rich in marine life, and on its fishery resources depends a sizable human population for a living. In it are situated several islands habitually used by large congregations of nesting water birds; two of these, South Bird Island, near the north end, and Green Island, near the south end, are particular charges of your Society under fifty-year leases from the state by legislative enactment. There is a present project of the U. S. Engineers to construct an hydraulic fill causeway across the northern end to give access to the barrier islands of Padre and Mustang for recreational purposes.

Your Society, the Texas Fish, Game and Oyster Commission and the U. S. Fish and Wildlife Service have registered their opposition to this project and are convinced that irreparable damage would ensue from the construction of such a causeway; that the Laguna Madre would, in such event, fill up rather rapidly and cease to exist. We are not averse to a consideration of the biological consequences of the construction of an open trestle-type causeway.

You will be interested to learn that there is an important new factor in this situation and that is the existence of Public Law 732 enacted at the last session of our federal Congress. We referred, at some length, to this legislation in the May-June 1946 issue. The important feature is that such engineering projects may no longer be undertaken by the U. S. Engineers on the basis of navigation considerations only, but that now the approval, after due investigation, of the U. S. Fish and Wildlife Service and the state agency involved (in this case the Texas Fish, Game and Oyster Commission) is required. In the absence of this new law, the engineers might have disregarded the objections of the conservation agencies and proceeded with construction which, among other consequences, would undoubtedly eliminate

the use of the islands in the northern portion of the Laguna as bird-nesting sites and destroy the livelihood of a goodly number of people dependent upon its fishery resources.

A NEW MAGAZINE

There are doubtless a good many members, especially new ones, who are unaware of the existence of *Audubon Field Notes*, recently distributed as an insert in *Audubon Magazine*, but sent only to those who had expressed a desire to receive them. Many others would surely like to receive these interesting and valuable records of ornithological observations, and those who are already receiving them are, of course, anxious to see the content expanded.

All hands, then, will presumably be delighted to learn that it has been decided that the Society issue *Audubon Field Notes* as a separate magazine, with its own publication dates. We have not been satisfied with the geographical cov-

erage in the Season Reports, or the need of leaving out each year some of the Christmas Count records. The Breeding-Bird Census is gaining increased recognition as a valuable scientific contribution, and we would like to expand its content. The chances of our accomplishing these aims are greatly enhanced through the decision to publish *Audubon Field Notes* as a separate magazine.

The current print order of *Audubon Field Notes* is so small that the unit cost of production is very high. As a separate magazine, we aim to promote its larger circulation to bring the *Notes* to the attention of a far greater number of people and, incidentally, bring down the unit cost. In order to meet the current cost of production and distribution, it has been decided to establish an annual subscription rate of \$2 for *Audubon Field Notes* as a separate magazine. As the circulation increases, savings in cost should be reflected in expansion of content.



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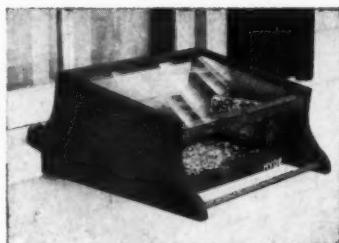
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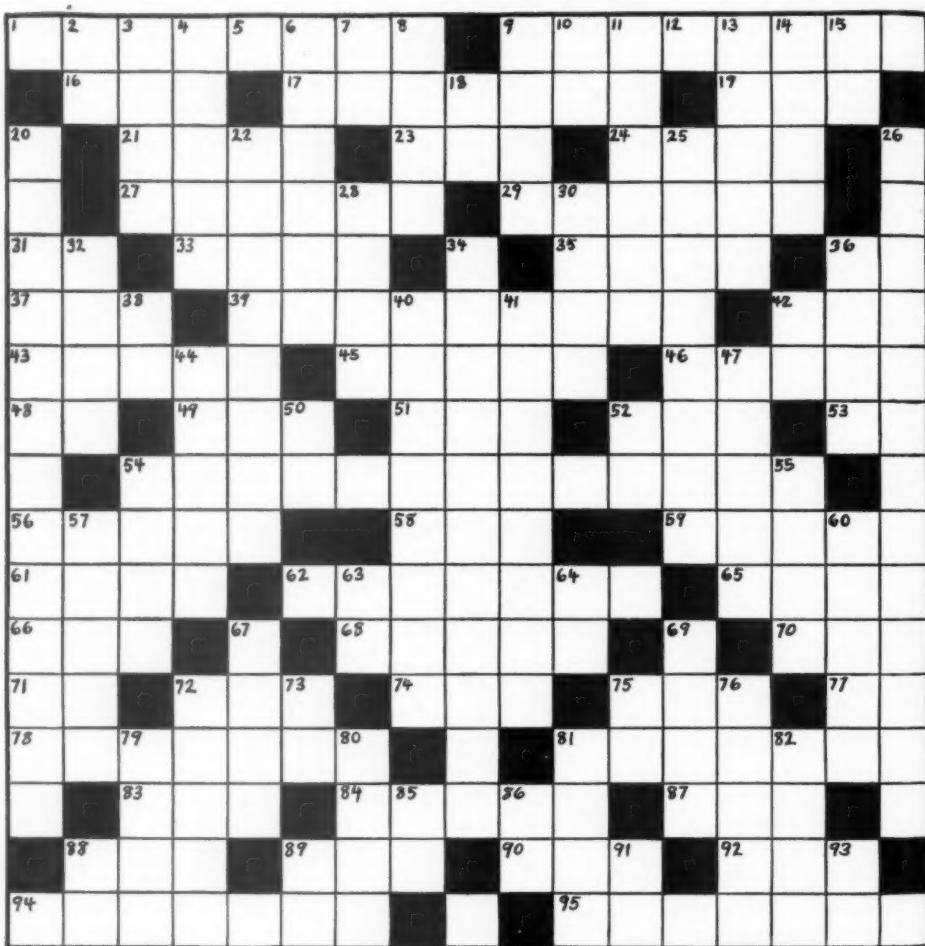
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BIRDS in CROSSWORD

By Allan D. Cruickshank



HORIZONTAL

1. A large woodpecker.
9. Family of New World birds.
16. Extinct bird of New Zealand.
17. Reproducing by conjugation of like gametes.
19. It's red on vireo olivaceous.
21. A kiln recalling New World warbler.

23. Large Australian ratite.
24. Spanish linen.
27. Bird seen incubating eggs.
29. Throw again.
31. Steamship.
33. Frequent perch of birds.
35. Short for ye shall.
36. 16th letter of Greek alphabet.
37. Usual clutch of mourning dove.
39. Family of rhododendron.
42. What are warblers full of.
43. Large raptorial bird.
45. Marsh birds.
46. Grasp.
48. Registered nurse.
49. French friend.
51. Long-life organization (abbr.).
52. Cry of sheep.
53. Preposition.
54. Study of feathered areas of birds.
56. Keep away.

58. International rugby games (abbr.).
 59. Soil.
 61. Sea swallow.
 62. Tropical gannets.
 65. Variant of anew.
 66. A feline.
 68. Turns.
 70. Hindu title of wealth.
 71. House of Lords (abbr.).
 72. What occurs when crows find an owl?
 74. Unit of energy (GGS system).
 75. Female deer.
 77. Adjective suffix.
 78. Got away.
 81. Unbeliever.
 83. A short poem.
 84. A dye.
 87. Suffix.
 88. The mate of a buck.
 89. One of the alcidae.
 90. One of the cuculidae.
 92. Snakelike fish.
 94. Mother Carey's chickens.
 95. A common city bird.

VERTICAL

2. I am.
 3. Bird renown for weird laughter.

4. Nesting site of many cliff swallows.
 5. Article.
 6. One who tints.
 7. Is (French).
 8. One who performs.
 9. Second sign of Zodiac (obsolete spelling).
 10. Part of verb to be.
 11. Genus of snowy owl.
 12. Article.
 13. Birds often flying in V-formation.
 14. Unfledged bird.
 15. Prefix (to repeat).
 18. Gram (abbr.).
 20. Large shorebird.
 22. Valued.
 25. Common name for red-polls.
 26. Goatsuckers.
 28. Arabian ruler.
 30. What are golden on the whistler.
 32. One of the cyninae.
 34. Birds that stitch leaves together.
 36. Popular title for English sparrow.
 38. King conquered by Moses.
40. The smallest U. S. hummingbird.
 41. Obstructing.
 42. Pennsylvania.
 44. Dead language.
 47. Biblical name.
 50. To go (Spanish).
 52. Bleat of lamb.
 54. Gull's favorite hangout.
 55. Japanese coins.
 57. Calves (obsolete).
 60. Nest of bird of prey.
 63. Ridge of drift (geology).
 64. Part of verb to be (Latin).
 67. Back part of neck.
 69. A comfortable seat.
 72. A shorebird.
 73. Musical note.
 75. Abbr. for Our Lord (Latin).
 76. A large duck.
 79. Ducklike rallidae.
 80. God in Latin.
 81. Taverns.
 82. A horned quadruped.
 85. All right.
 86. Suffix.
 88. From (Latin).
 89. An Indian mulberry.
 91. Installment paid (abbr.).
 93. Behold.

LETTERS

Letter from the Editor:

Out West, our friends are staunch and true, but they tell us that *Audubon Magazine* will never have "audience appeal" for westerners, until we include articles about their section of the country.

Western authors are far away and hard to find, but we're beginning to make a dent. Last year, we published three articles on the West—one a picture-caption story about Western habitats (Arizona); one on the Cascade Mountains in Washington and one on the Wyoming elk.

For our next issue, Howard Cogswell has written about the elfin forest or the chaparral; and for May-June, Robert T. Orr of the California Academy of Science has written about summer shorebirding in California.

This month, Josephine Willis (page 20) carries the torch for California. Mrs. Willis is one of the mainstays of the Los Angeles Audubon Society, and has served on their board for the past three years. She became diet and vitamin conscious during the first World War when, as a Red Cross worker in

Chicago, Ill., she played the role of family doctor in Logan's Grand Chapter of 8000 members.

Mrs. Mary Hood, vice-president of the LAAS, has made many beautiful kodachromes of Mrs. Willis' baby birds, some of which have been reproduced in black and white in this issue.

Ken Stott, Jr., (page 13), of the Zoological Society of San Diego, also represents California in this issue, although he writes about Philippine birds. His interest in exotic species goes back to the age of ten when he first began work at the San Diego zoo. He will soon produce Westerns for us, however, for when approached on this subject, he sent this enthusiastic reply:

"Of all this section of the country, I like best the Salton Sea area which resembles in more ways than one the Nile delta. Each winter thousands of birds—ducks, geese, swans, cranes—pour in on migration from the North. During summer, birds from the Gulf of Lower California wander in on post-breeding migration. The setting, itself, is magnificent—mile after mile of rice paddies and date orchards. To the east, lie the rolling Yuma dunes; to the west, barren purple mountains of travertine; and to the south, the open desert is broken only by an occasional wash or outcropping of volcanic rock until it reaches the Gulf of Lower California. What country!"





Did you ever think of joining an Audubon Wildlife Tour on your honeymoon? John Dennis (page 2) did just that, so we list it as item No. I in this brief biography. A graduate of the University of Wisconsin, he has been a park ranger, a defense worker in Puerto Rico, a globe-circling soldier in the Signal Corps and an employee of the Fish and Wildlife Service, stationed on the Delta National Wildlife Refuge. He is now doing educational work for the Massachusetts Audubon Society.

Ernest C. Driver (page 47) is Associate Professor of Zoology at Smith College and author of a 500-page book entitled "Name that Animal"—a guide to the common land and fresh-water animals of the U. S. with special reference to the area east of the Rockies. . . . Hugh H. Bennett is known as the evangelist of the conservation movement and his article "Revolution on the Land" was presented last October as a speech at the Princeton University Bicentennial Conference in Princeton, New Jersey. . . . Ludlow Griscom, as you know, is chairman of our board. His "Ornithologist Takes a Look at Waterfowl" was presented as a speech at our annual banquet last October, and has also been printed in the Bulletin of the Massachusetts Audubon Society.

One of our members down in Louisville, Ky., was so impressed with "Let's Bring Wildlife Back to the Woods," by John Terres (September-October issue) that he has been purchasing copies of that issue to distribute to friends. If you would like to follow his example on this or any other article that may be a favorite with you, we will supply copies at a discount, if extra copies are available. Sometimes we over-estimate on our print order and sometimes the printer has an overrun. When this occurs, we can furnish you with "missionary" copies at 10¢ a piece, plus postage, if you order in quantity.

Newton Drury of the National Park Service thought so well of "Let's Bring Wildlife Back to the Woods" that he had excerpts mimeographed and distributed to all of the Service's field offices. The article has been reprinted by a number of other magazines as has, also, Frederick Lincoln's "Keeping Up with the Waterfowl." The Fish and Wildlife Service bought a thousand reprints of Mr. Lincoln's article, to be distributed by them.

Recently, a request came from the State Department for permission to translate "Conservation Workshop" (March-April) into foreign languages. Here's a quotation from the letter:

"We would like to send the article to Germany and Austria for translation and possible republication in one or more of the German-language peri-

odicals now operating under license from the United States Military Government.

"Provision of material for the so-called 'license press' in occupied areas is a function of the Civil Affairs Division of the War Department working in cooperation with the Office of International Information and Cultural Affairs of the State Department. The objective is to acquaint the German and Austrian public with the thinking of the outside world—particularly with American thinking and achievement.

"There is a possibility that we may wish to send the article later to one or all of the other areas which we service—the Far East, Italy, Latin America, Algiers and Russia."

Ever so often, we take space to confess our sins in public. Do you remember that lovely picture on page 227 of the July-August issue, captioned "Franklin's gulls"? A letter from Ludlow Griscom informed us that all of Boston was laughing over that one—and quite appropriately, too, since the birds were laughing gulls! The error was caught in page proof—even though my temporary office at that time was a hospital bed—but the correction did not reach the printer.

And then there was that "rock specimen" on page 273 of the September-October issue. Dr. Palmer took the whole thing as a huge joke, but he would like to have you know that beavers chew logs made of wood—not stone!

E.A.K.

To the Editor:

Every Monday afternoon for more than a year, a member of the California Audubon Society has visited Children's Hospital, Hollywood, to take flowers to the Orthopedic Ward and talk to the little patients about birds. Miss Mary Ferguson Coble is chairman for this work, and Miss Helen Pratt and Miss Blanche Vignos have assisted.

A brief description of seventeen birds which Miss Coble wrote in simple verse proved so popular with the children that she had it printed, with silhouettes of the birds to color, and blank pages for descriptions. When a child has colored the pictures, ceramic clay is provided for modeling the birds. These figures are baked in an ordinary oven and painted in color under the direction of the hospital's Occupational Therapy Department.

While the booklet was being printed, reassurance had to be given to the convalescent children who were afraid that they might be sent home before it was completed. They were delighted to receive their gift copies before they left.



The patients ask such questions as: "Which bird can fly fastest and how far can it fly?" Naturally the answer sometimes has to be, "I don't know but I'll look it up." The children never forget to repeat the question the next time the visitor appears.

Pictures, Audubon bird song records, Junior Audubon leaflets, a Christmas tree for the birds, and poems and stories about birds have been used to illustrate the informal bedside talks. Arrangements are now being made to bring specimens of the birds discussed from the loan collection at the Los Angeles County Museum.

This work was begun as the result of an article in *Audubon Magazine* by Mrs. Wilhelmina Gulotta, on the staff of the General Hospital, Lincoln, Nebraska, and has been accepted as a part of the Volunteer Service at the Hollywood Children's Hospital. As the patients often remain for several weeks or months, it is possible to make some headway in discouraging thoughtless or cruel injury of birds and emphasizing the satisfaction of acquaintance with the extensive bird life of California and its importance in nature conservation. Their bird study helps the boys and girls through some difficult hours and gives them an interest which it is hoped will continue to grow when they can be outdoors again.

MERTA WHITE

Secretary
California Audubon Society

To the Editor:

I never expected to see the day when *Audubon Magazine* would publish a crossword puzzle! However, now that I am used to the idea, I think it is a "natural." I enjoyed working it out and hope there will be many more.

GORDON IRVING

Teaneck, N. J.

To the Editor:

Alan Devoe has long been a favorite with me. He reminds me more and more of Thoreau.

ERNA COMBY

Whittier, Calif.

To the Editor:

Congratulations on the *Audubon Magazine* for September-October, in fact on all the numbers of the magazine. The NAS is to be given an immense amount of credit for putting out one of the prettiest and most effective nature magazines in the country.

I particularly appreciate the story by Edwin Way Teale on E. Laurence Palmer in the September-October issue. It is all too seldom that the leaders in our field receive the appreciation they should have, and Palmer is one who richly deserves all the credit that will ever be given to him.

WALTER P. TAYLOR

College Station, Texas

AUDUBON FIELD NOTES

To Become a Separate Magazine

Audubon Field Notes is published six times a year and is composed of four season reports (Fall Migration, Winter Season, Spring Migration, Nesting Season), a Breeding Bird Census and a Christmas Count.

Previously published as Section II of *Audubon Magazine*, and mailed with it, *Audubon Field Notes* now becomes a separate magazine and will be mailed separately. The subscription price will be \$2.00.

If you are already entitled to receive *Audubon Field Notes* for a stated period, it will be mailed to you, without extra charge, until expiration date. Renewal notice will then be sent you.

The schedule of publication of *Audubon Field Notes* will be until further notice:

January.....	Fall Migration
March.....	Christmas Count
May.....	Winter Season
July.....	Spring Migration
September.....	Nesting Season
November.....	Breeding Bird Census

There will be some delay in your receipt of January and March issues this year, because of the change that is being made.

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Canadian Nature Magazine. This popular magazine presents in attractive form brief, interesting, up-to-date information on subjects in all the nature sciences and contains questions and activity ideas, art work and projects for each season. It is written by authorities and illustrated by the best photographers and artists. Canadian Nature is issued in September, November, January, March and May. The five numbers contain approximately 200 pages, 90 articles, 35 colour plates, 160 photographs, 220 figure drawings. It was founded in 1939. The press run now exceeds 35,000 copies of each issue. By encouraging an intelligent interest in nature and emphasizing the need for conservation of our natural resources, this magazine is making a real contribution to individual and national character. Recommended by the American Association of School Librarians. Also approved by National Audubon Society; National Headquarters Boy Scouts of America; National Headquarters Girl Scouts Inc.; American Nature Study Society. It makes an ideal gift. It should be in every home, school and library. Subscriptions \$1.25 a year.

Nature Activities. 50 cents. A practical, usable handbook for teachers, students, librarians, camp counsellors and all others actively interested in nature and conservation. The new edition of 64 pages and cover is simply brimming with hundreds of suggestions for the teaching of Natural Science. It contains chapters on the organization and leadership of indoor activities and field trips, the making of collections, exhibits and classroom museums, instructions for nature arts and handicrafts, and hundreds of definite activity suggestions, arranged seasonally week by week throughout the year. Profusely illustrated with photographs and 192 drawings. Since first published in 1943, six editions totalling 38,000 copies have been printed. Prompt service on mail orders.

Wild Flowers. \$1.00. Contains fifteen beautiful reproductions in full colour of favourite wild flowers, painted for Canadian Nature by Barrie Rennie, noted Canadian artist. The subjects are: Skunk Cabbage, Trailing Arbutus, Hepatica, Dutchman's-breeches, Adder's-tongue, White Trillium, Jack-in-the-pulpit, Blue Violet, Showy Lady's Slipper, Yellow Lady's Slipper, Twin-flower, Bloodroot, Joe-Pye Weed, Bunchberry and Bittersweet. When framed the pictures make ideal gifts or decorations. Each page is printed on one side only, so that single pictures may be conveniently detached. Seven editions totalling 22,000 copies have been printed.

Canadian Birds. 35 cents. Seventy-five birds in their typical environment. A fascinating panorama of native bird life by L. L. Snyder, Curator of Birds, Royal Ontario Museum of Zoology. Beautifully illustrated with pen and ink drawings by T. M. Shortt. Two editions totalling 8,000 copies have been printed. You will like this booklet!

Conservation Illustrated. \$1.00. This authoritative and important volume of 128 pages and cover presents a graphic picture of the natural resources of Canada, the part they have played in its development, the manner and consequences of their use—and misuse. Through stimulating reading, basic information, and approximately 200 photographs and drawings, Conservation Illustrated makes clear the imperative necessity for conserving forests, waters, soil and wildlife, and tells how this may be done. It has been prepared in collaboration with government officials, educators and conservationists in every province. Contains up-to-the-minute reference material, teaching suggestions, review questions and pupil activities. Every public-spirited person should send for this revealing volume.

Native Ferns. \$1.00. Our newest booklet! Read the fascinating story of liverworts, mosses, ferns and their kin. Virginia S. Eifert describes them and tells how they differ from other common plants; where to find them; their economic significance; how they grow and develop. You will be thrilled with the beauty of 73 photographs of ferns by Bruce Metcalfe. Many other illustrations and drawings. 64 pages and cover. Send copies to your friends.

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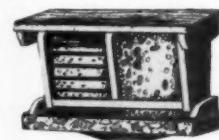
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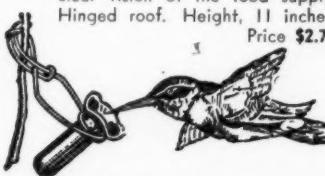
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No. 12
tree trunk or pole. Roof is removable. Size:
10 inches.

WREN HOUSE

Shown at right. Rustic home
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Size 7½ inches. Easily
cleaned by removing bot-
tom strip. \$1.25
With bracket 1.55

BLUEBIRD COTTAGE

This house is a favorite with Bluebirds.
Of rustic hemlock.
Has a flat back for
mounting against
tree trunk or pole. Roof is removable. Size:
10 inches.



No. 7

TREE SWALLOW HOUSE

Shown at left. Also suitable
for Bluebirds. Removable
bottom for cleaning. Height
10½ inches. \$2.75



CHICKADEE HOUSE

At left, a rustic home
for such woodland
birds as chickadees
and nuthatches.
Height 13 inches.
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No. 30

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A 32-page booklet, illustrated
with 14 photographs. Discusses
the value of song-bird sanctuaries,
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No. 8

BIRD BUNGALOW

T. M. Registered,
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At right, shown with hole
for Bluebird, Tree or Violet
Green Swallow. Equipped
with two adapter holes
(under bottom), the me-
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No. 215

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